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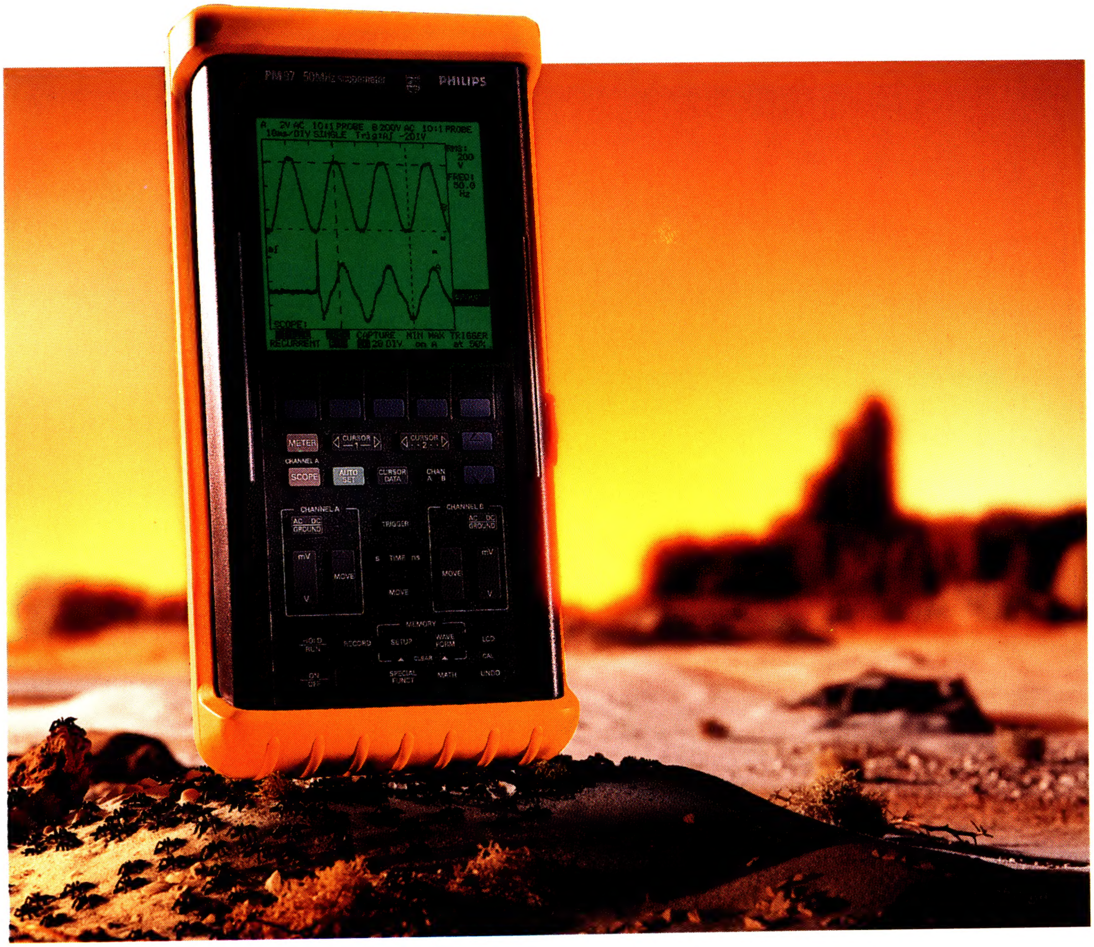

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AUSTRALIA WITH ETI

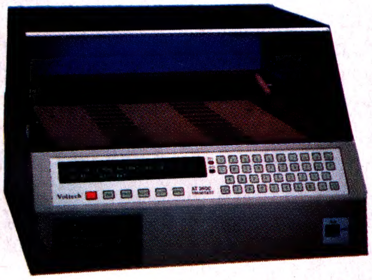
Volume 56, No.6
June 1994

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

The ABC's beam into Asia

ATVI, the ABC's C-band satellite service to Asia, is now into its second year of operation. Barrie Smith looks at what's been achieved to date in his story starting on page 26.

Automatic txfmr tester



Traditionally, transformer testing has been costly and time consuming. But UK firm Voltech has changed this dramatically, with its new microprocessor controlled and easily programmed automatic transformer testers. See our story on page 112.

On the cover

Federal Publishing's receptionist Robin Morrey kindly volunteered to model the new Koss Quiet Zone 1000 noise-cancelling headphones for us, when they arrived after Louis Challis had reviewed the ANVT originals. You'll find Louis' review starting on page 8. (Picture by Peter Beattie)

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MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
GRAPHICS/PRODUCTION EDITOR
Milli Godden
TECHNICAL EDITOR
Rob Evans, CET (RMIT)
TECHNICAL CONSULTANT
Peter Phillips, B.Ed., Dip Ed., ECC
CONTRIBUTORS
Louis Challis
Arthur Cushen, MBE
Peter Lankshear
Jim Lawler, MTETIA
Tom Moffat, VK7TM
Neville Williams, FIREE, VK2XV
Major Al Younger (USAR, Ret.)
DRAFTING
Karen Rowlands
COVER DESIGNER
Clive Davis
PRODUCTION
Ray Eirth
CIRCULATION MANAGER
Michael Prior
PUBLISHER
Michael Hannan
ADVERTISING MANAGER
Selwyn Sayers
Phone (02) 353 0734; fax: (02) 353 0613.
ADVERTISING PRODUCTION
Karla Dixon, phone (02) 353 0713
SECRETARY
Ana Maria Zamora
HEAD OFFICE - EDITORIAL
P.O. Box 199, Alexandria 2015.
180 Bourke Road, Alexandria 2015.
Phone: (02) 353 0620. Fax: (02) 353 0613
Reader Services: Phone (02) 353 0620
Subscriptions enquiries: phone (02) 353 9992
Book Shop enquiries: phone (02) 353 9944
INTERSTATE ADVERTISING OFFICES
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Fax: (03) 701 1534, Pilar Misa.
BRISBANE: 26 Chermside Street, Newstead, Qld 4006. Phone: (07) 854 1119.
Fax: (07) 252 3692, Graham Smith.
ADELAIDE: 98 Jervois Street, Torrensville, SA 5031. Phone: (08) 352 8666,
Fax: (08) 352 6033, Sue Bowshall.
PERTH: Allen & Associates, 54 Havelock Street, West Perth, WA 6005. Phone: (09) 321 2998,
Fax (09) 321 2940, Tony Allen.
UNITED KINGDOM: John Fairfax & Sons (Aust), 12 Norwich Street, London, EC4A 1BH.
Phone: (71) 353 9321, Fax: (71) 583 0348
ASIA: Headway Media Services Ltd, Room 2101, Causeway Bay Centre, 15-23 Sugar Street, Hong Kong. Phone: 516 8002,
Fax: (862) 890 4811, Adrian Batten.
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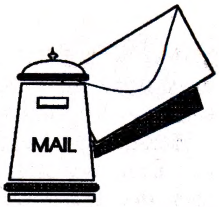
LETTERS TO THE EDITOR



32V radio history

I read *EA* with interest each month, as I have since 1954. Perhaps the columns that I read most would be Vintage Radio, When I Think Back, The Serviceman, Moffat's Madhouse and Forum.

I have a request that may be suited to a Letter to the Editor or perhaps to Neville Williams — When I Think Back.

I have been researching the era of the 32 volt lighting/power plant in Australia and the 32 volt radios (to a lesser extent) that were used with these 32 volt power sources. I have not been able to get very much information on the history, development or use of this system of light and power supply for rural Australia. I am familar to the extent that I was brought up on a farm and we did have a 32 volt lighting plant and later on, I used to service 32 volt radios.

I don't even have a wiring diagram of a typical 32 volt lighting plant. One often-asked question is "Why 32 volts?" I don't know and no-one else has been able to come up with a good answer.

It is my desire to research this topic as best I can and provide an article which gives the history, development and use of 32 volts in Australia. The information is disappearing at an alarming rate and even asking the older generation I can get little information. I see your magazine as one of my last hopes of being able to get this information together for our future, before it is lost forever.

Rodney Champness, VK3UG
Benalla, Vic.

Comment: We'd be surprised if some valuable information isn't forthcoming from some of our readers, Rodney — they're a mine of information. We'll pass on any material that arrives, and good luck with your project.

Freon defended

In your defence against the 'Brickbat' from Peter Moon (March *EA*), may I offer the following. In my day the ozone layer was a bi-product of the filtering effect of oxygen (0_2) on the UV rays, 0_3 itself having little effect. This is supported by the fact that there is no ozone layer (a hole in fact), over the 'polar nights' where there is no solar radiation for many months of the year.

Secondly, as far as I can remember, the relative densities of chlorine, freon and other fluorocarbon compounds released into the atmosphere are such that they would act much like a brick in a pond of water. Mere man with all his efforts could hardly affect the stratosphere as much as one good volcano. Likewise the gasses from farting cattle, which would burn up in one good lightning flash anyway.

Enlightened scientific opinion has already consigned the ozone hole scam to the same bin as a previous scare tactic called the nuclear winter, except of course those who stand to profit from the sale of the new expensive replacement refrigerant. Long live Tom Moffat — and his beautifully sane madhouse.

Philip Madsen,
Nanango, Qld.

Preamp source

Could you please add a footnote to Tom Moffat's column (or elsewhere) to the effect that the Post Office Box for the Wireless Institute of Australia SA Division's Equipment Supply Committee (WIA ESC) is now:

P.O. Box 789,
Salisbury, SA 5108

A number of people are still ordering 2m preamps from P.O. Box 392, Marden, presumably using the address given in *EA* August 1992. P.O. Box 392 is rarely checked nowadays and will be cancelled in April.

We apologise for the delay in filling orders to those who have recently sent orders to the old address.

I'm on the periphery of the ESC now, but I know the boys are still getting preamp orders regularly. The ESC is a membership service for the WIA SA Division, and we don't seek publicity, but do not wish to inconvenience those who may wish to order from us.

Mark Spooner,
Vale Park, SA.

Mysterious units?

Again I have read and enjoyed February's *EA* from cover-to-cover, However, this time I discovered that I must be bit pedantic.

Tom Moffat says that robots and computers were initially introduced to make our jobs easier, but had in fact, in many cases, eliminated our jobs completely.

Suddenly it dawned on me that this is what must have been the fate of sub-editors and copy-readers.

Messrs Jeans and Woodward gave us two excellant articles on solar-powered cars, that were both liberally splattered with a mysterious metric notation: kph!

A lower-case k is kilo and a small h can be taken to be hour(s) — we all know that — but what is a little p?

Maybe it was what the drivers of the cars did behind a tree.

It cannot mean per as this is given as a SLANT or an OBLIQUE STROKE. And if metres were involved, what happened to all the little ms?

Next time either of these contributors turn in copy, please ask him to run it through a computer. Remingtons were Ok in their day, but now we have PCs with in-built Thesauruses and Dictionaries. They'll even tell us how many times they have had to substitute km/h for kph. The subbies and readers can continue to keep Tom company down at the CES.

Only joking...

Gordon Browell,
Maryborough, Qld.

Screen wobble

I refer to 'Delinquent PC', a letter to the editor, in December 1993. It was interesting to read of the problem that Mark is experiencing, as I have had installations with the same screen wobbles and have noticed that the problem is more evident with SVGA monitors and that in all cases the home or office uses electric heating in the slab. If this form of heating is used at Mark's home, then isolating the floor heating circuit breaker during the wobbles will quickly verify if this is the case.

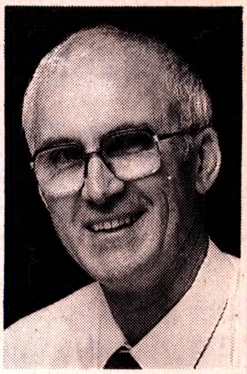
In the event that this cures the screen wobbles, then the removal of the source is a tad difficult and may incur the wrath of the rest of the household, particularly during winter. A Faraday Shield placed under the top of the computer desk may help, or a suitable shield (Mu metal), around the neck and yoke of the monitor tube, although more difficult to fit safely, should do the trick.

I have not had to resort to these measures as careful relocation has minimised the problem cases — so far.

Neil Cox,
Ballarat, Vic.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Are YOU happy in our global communications backwater?

What's the actual purpose of this 'editorial chat' column, or *leader* as it's often called, in a technical magazine like *EA*? Well, sometimes it's to allow me to add useful background information on some of the articles or news items in the issue, to put them more clearly in context. Often I guess it's also to give the magazine a 'personal' human face, and perhaps reassure readers that the editorial material you find on the following pages hasn't been simply churned out by a computer, without human intervention...

One of the things I *do* certainly try to do here is comment on recent technical developments (or the lack of them), and in a way which is sometimes deliberately provocative. Why? I suppose it's because I think the matters concerned are important, and I want to get readers thinking about them. Sometimes the only way to achieve this seems to be by putting things in a way which you know is likely to irritate and upset people.

Here goes again, then. We in Australia and New Zealand like to think of ourselves as living in a developed and technological society, don't we? Always eager to grasp new technology, and use it to our advantage — or so we think. But in some areas at least, *I* think we're kidding ourselves.

In a recent issue of *Coops Technology Digest*, an industry newsletter published by Robert Cooper in New Zealand, I read that our South Pacific region lags behind virtually every other area of the world, in terms of access to satellite television programming. As Mr Cooper points out, even a dish owner in a humble village in Bangladesh typically has access to 40 programme channels, on a regular basis.

In contrast, New Zealanders as yet apparently have access to only one full-time service (CNN), while in Australia the only 'official' full-time service is BMAC-encoded HACBSS/RCTS material, intended purely to allow people in remote country areas to receive our ABCTV and a local commercial channel or two. Apart from picking up the occasional news feed or promo from Optus transponders, only dedicated enthusiasts with big dishes and remote actuators, etc., can receive much else. (Domestic BMAC receivers aren't even made or sold anymore, as I understand it.)

I know there's 'good economic reasons' used to explain this lag. Both countries have relatively small populations, spread over wide areas, so additional programming supposedly can't be provided economically. I've also heard that if-it-ain't-broke-don't-fix-it reasoning, along the lines 'Why do we want 50 more channels, or even 500? Have you seen what those extra channels provide in the USA, etc? It's all RUBBISH!'

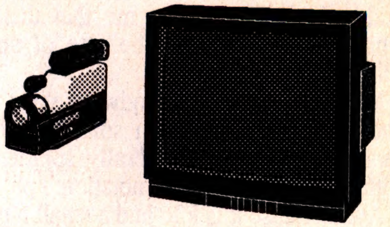
I don't know about you, but personally I find these explanations and reasoning quite unsatisfying. All I know is that most of the world is taking part in an exciting global communications revolution, but Australia and New Zealand seem to have barely noticed — let alone decided to take part. It seems to me that we'll miss out on all kinds of opportunities, if we don't get moving soon.

What's the real reason why, in 1994, *we* still have less freedom of choice and access to world news and other material than a Bangladeshi villager? Is it because we've inherited a paternalist media bureaucracy, which still believes in tight and centralised media control — or because we have elected politicians who don't have the guts to risk upsetting our current media moguls?

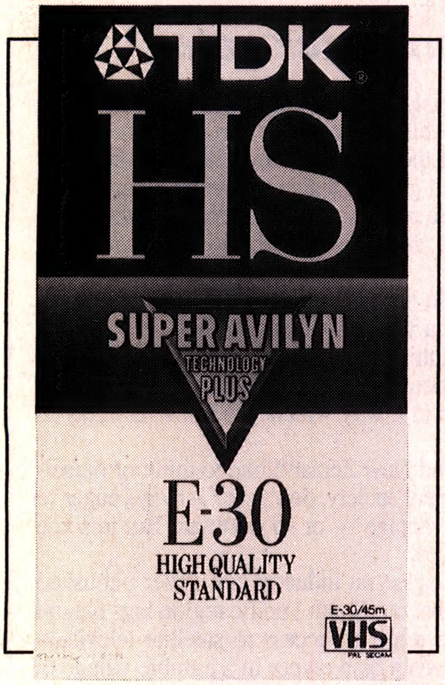
I don't know. But whatever it is, we need to fix it, and fast.

Jim Rowe

What's New in VIDEO and AUDIO



30m in video, 10m in audio tapes



TDK, which claims to be the world's largest supplier of video cassette tape, has introduced an E-30 HS (30 minute) tape to compliment its existing E-60, E-120, E-180 and E-240 minute playing times in the popular HS or High Quality Standard formulation.

Camcorder users favour a shorter tape time for dubbing, rather than using E-120 and E-180 tapes and wasting unused footage or being limited to only premium grades.

Until now TDK had supplied E-30 only in its HDX-Pro grade, contending that the demand for this playing time was mainly used for mastering and professional applications.

TDK's HS grade uses its proprietary Super Avilyn technology, in combination with a specially developed three dimensional high density webbed matrix binder. The HS E-30 has an RRP of $7.95 and is available at selected TDK dealers and department stores.

TDK has also introduced a 10-minute playing time in its audio tape D formulation. TDK's Normal/Type 1 Position D type is the company's best selling tape, with sales accounting for over 60% of all audio cassette tape sales. The new D-10 supports the existing D line-up of 46, 60, 90 and 120 minute playing times, and like the others uses the company's improved Pure Grained Ferric particle formulation.

Range of Ross headphones

The quality range of Ross headphones from the UK is now available in Australia exclusively through the Electronic Enterprises and Record Music group outlets. Styled for comfort with great sound quality, Ross headphones have achieved considerable success in the UK and a strong following in Europe.

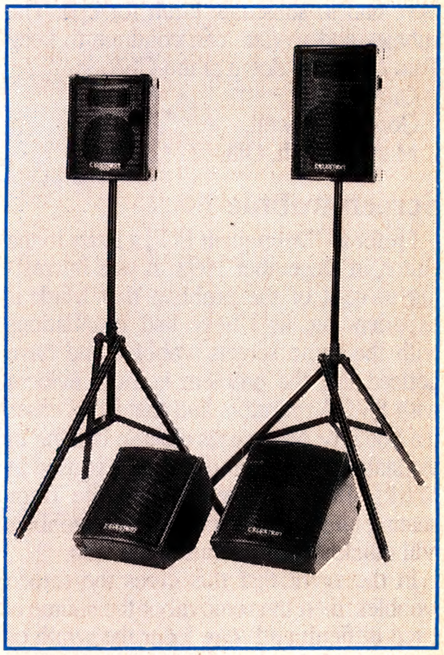
Top of the range units offer a frequency response flat from 15 or 18Hz to 32, 25 or 22kHz depending on the model, while all others are rated flat from 20Hz to 20kHz. Impedances are designed from four ohms to 32 or 100 ohms. Sensitivities range from 90 to 110dB, according to model.

Attention to detail in the hi-fi stereo phones extends to adding independent volume controls in some models. The high velocity samarium-cobalt drive units with ultra thin, Mylar Dome diaphragms give the lightness that contributes to wearer comfort while achieving sound quality by providing wide range, distortion free response.

Ross offer a wide selection of models, which include hifi top of the range, video TV phones with extra long leads, folding personal earphones, super lightweight and micro stereo units. A superior hifi infra red cordless model has just been added to the line. Retail prices vary from $30 up to $299.

Further information from Ross Electronics, PO Box 652, Avalon NSW 2107, or phone (02) 974 1768.

Compact, low cost professional speakers



The new Celestion CR Series Professional Loudspeakers are portable, versatile and reliable enclosures designed to deliver accurate response, even at high sound pressure levels. The CR Series is claimed to be ideal for live performance sound reinforcement in clubs, restaurants or discos, or anywhere a budget priced, high quality portable speaker system is required.

The CR Series differs from Celestion's SR Series in that external electronic processors are not required. The new range includes internal crossovers and can be driven directly by amplifier outputs.

It comprises two compact two way enclosures, available as front-of-house or stage monitor versions; three way full range systems; and two subwoofer enclosures, complemented with a range of mounting and suspension accessories.

The CRi102 and CRi122 compact enclosures are two way systems featuring one 10" bass driver respectively, coupled with a horn loaded tweeter in a compact cabinet suitable for stand mounting. Power handling is 200W and 250W respectively. Both are capable of full range operation or may be used together with Celestion's CRi151 or CRi181 single 15" and single 18" subwoofer enclosures for extended low frequency response. Both two way systems are available in stage monitor versions, featuring identical components mounted in angled cabinets for minimum stage height.

The CRi153 three way system features 15" LF and 6" MF drivers coupled with a horn loaded tweeter, and is capable of 300W continuous program power. The CRi183 features 18" LF and 10" MF drivers together with a horn loaded tweeter, and boasts 500W continuous program power handling.

CR Series cabinets employ multi-ply yellow pine construction finished in a black triple weave carpet, dadoed glued and jointed with steel fasteners and rigid internal bracing, and are fitted with 18 gauge perforated polyester powder coated grilles for maximum driver protection. All CR Series cabinets share a 8.5 degree side angle to form arrays when used in multiples.

Celestion professional audio products are available from selected dealers across the country and are represented throughout Australia by Amber Technology. For further information please contact Amber at 5 Skyline Place, Frenchs Forest 2086; phone (02) 975 1211.

Two head 'Super Drive' VCR

Panasonic has recently launched the NV-SD1 two head video cassette recorder, designed to compliment the company's 'Super Drive' range and give consumers who want to buy the quality of Panasonic the opportunity, without spending the money on a three or four head VCR.

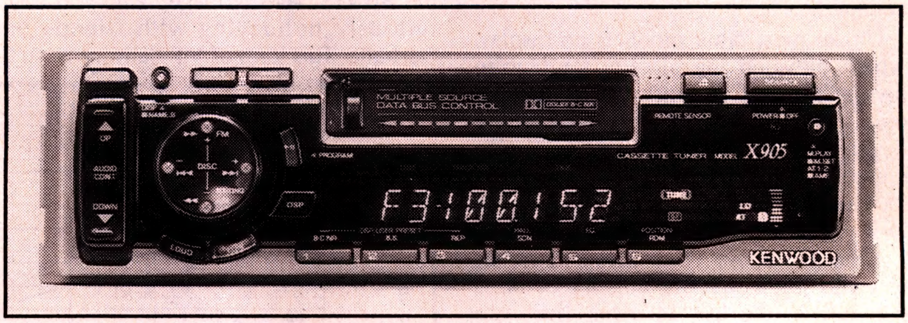
As with all the Panasonic 'Super Drive' VCR range, the SD1 has a one piece aluminium diecast chassis which maintains rigidity and greatly increased reliability. The Direct Drive cylinder motor is claimed to have 99.999% rotational accuracy, for a consistently smooth picture.

The SD1 has a Video Index Search System which allows the user to go to the beginning of a recording by simply pressing a button on the remote control. If the program required is the third separate recording then the user would press the button three times to reach the beginning of that program.

Another feature on the SD1 is 'Quick View' which operates with Fast-Fast and Rewind. It allows the user to have a view of the picture when the machine is in FF or REW mode. A palm sized remote control operates all features of the VCR. It also has a one month eight program calendar timer.

The Panasonic NV-SD1 video cassette recorder is available from electrical retailers for a recommended retail price of $549.

Car system features DSP



Kenwood's new System X905 car audio system is the company's flagship digital signal processing system, designed to 'take car audio systems into the 21st century'. The complete X905 system comprises the X905 cassette tuner with CD control, the P705 digital signal processor and a C705 multiple CD player, plus a suitable amplifier and speaker system.

At the heart of the X905 system is the X905 cassette-tune CD changer controller, which acts as the control station for the DSP unit, up to two C705 multiple CD players plus other Kenwood products which incorporate the company's proprietary 'Bus Line system' or K-Bus connection. This connects Kenwood's car audio components together and conveys both audio information and operational status. For example, the user can pre-set up to 100 eight-letter CD titles for display on the X905 centre unit.

The cassette section uses Kenwood's latest head technology and employs a hard wearing Auto Azimuth head which continually adjusts for correct tape to head alignment.

The P705 digital signal processor offers advanced DSP features, including simulation of six live venues including Concert Hall, Jazz Club, Stadium, Dance Hall, Church and Surround — recreating the ambience of these large venues all within the confines of a car.

Front and rear channels can also be individually adjusted for the correct 'surround' level. One touch selection of equalisation curves allows for pops, loudness, vocals, live house classic or flat reproduction.

The C705 is the world's smallest 10-disc multiple CD player, using Kenwood's advanced one bit DAC technology and its proprietary CPDC or Clear Pulse Drive Circuitry. Able to accommodate 10 CDs for hours of listening enjoyment, the C705 is designed primarily for boot installation and can be mounted in a vertical or horizontal position.

The system X905 can be bought as a system or as individual components. The X905 cassette-tuner/CD controller (RRP $1499), the P705 digital sound processor (RRP $1199) and the C705 multiple CD player (RRP $1099). ❖

ANVT's NQ100 Noise Attenuating Headphones

This month our reviewer Louis Challis had the opportunity to test a sample of the new 'Active Noise Attenuating Headphones' recently released in the USA by ANVT — and the subject of considerable interest at this year's Las Vegas CES. The ANVT phones use an inbuilt amplifier and phase-cancelling system to attenuate ambient noise, making them well suited for listening to music, etc in noisy environments such as aircraft.

One of the most popular exhibits at the recent Consumer Electronics Show in Las Vegas was the 'Koss Stand'. The popularity of the stand was unusual, as the interest was not raised by a product Koss had developed itself, but rather by their assistance in displaying the newly released NQ100 Active Noise Attenuating Headphones, from Active Noise and Vibration Technologies, Inc (ANVT).

(*Editor's Note: Koss is now also selling the 'phones as its 'Quiet Zone 100' — see Stop Press box elsewhere in this review.*)

ANVT have used Koss transducers in their first highly visible consumer product, and the addition of their product to the wide range of good and outstanding Koss headphones clearly appealed to the trade and media.

Unlike most other products on display, which elevated the already loud noise levels in the Convention Centre, this product alone provided its wearers with a degree of respite from the aural invasion created by a plethora of amplifiers and loudspeakers, each of which were vying for the attention of the attendees.

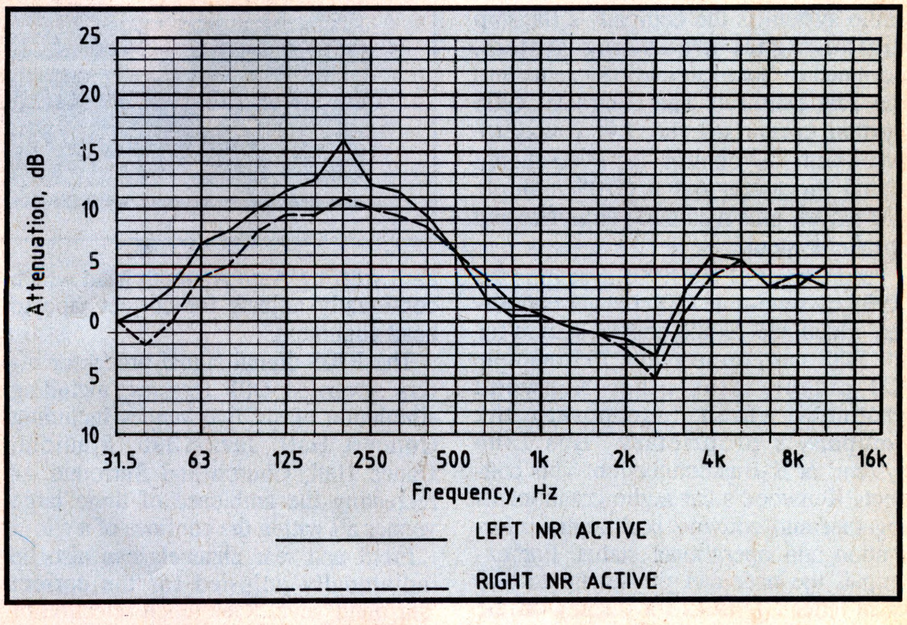
Although 'active noise attenuation' has received an inordinate amount of press publicity in the last 14 years, there are however relatively few practical examples of where it is being used, that either you or I could cite. Many readers of *EA* would recall my review article on the Bose Aviation Headset, and although I am aware of four prior practical applications of active attenuation, any progression past that tally would prove to be somewhat difficult. That minuscule tally did change last year, however, when DigiSonics of Wisconsin released its outstanding active noise attenuation systems for ducted air conditioning systems. Then in late October, ANVT released its NQ100 noise reducing headphones, which prospectively have a far wider market, and almost universal appeal amongst travellers.

ANVT is unquestionably an interesting company. Its headquarters are in Phoenix, Arizona, and with more than 200 people on its staff, it is growing at a rapid rate. That growth owes much to the proportion of technically trained personnel, the majority of whom are young and dynamic. The company has a large and fruitful R&D section, who have been actively (no pun intended) developing new products to solve other people's insidious or intractable noise problems. The products they have been developing range from quieter dishwashers and industrial fans at one end of the spectrum, right through to stand-alone consumer products like the NQ100's at the other.

My NQ100's were hand-delivered by the ANVT's Sales Manager, who was fortuitously holidaying with friends in Australia. This form of VIP delivery wasn't the firm's standard procedure, of course, but I would be the last one to complain, as it provided me with the rare opportunity to find out more about the company and its marketing plans.

Initial impressions

The first thing that caught my eye on opening up the cardboard box in which the NQ100's were packaged was the simplicity of the packing, and the paucity of the technical literature describing the product or its performance. The user guide states that 'Noise Cancellation is up to 18dB', and the 'Noise quieting bandwidth is 30Hz to 1400Hz'. It also highlights the potential for a 'psychoacoustic experience in most quiet environments, due to an absence of noise'. This phenomenon results in the sensation of reduced pressure on the ear, not unlike



The noise reduction characteristics of the ANVT NQ-100 headphones, as measured by Louis Challis using a standard acoustical test feature in the middle of a large reverberation chamber. One third octave band filters were used.

that experienced when descending in an aircraft, (or more relevantly) when standing in an anechoic chamber.

On closer examination of the box's contents, I noted the unusual design of the headphones, each of whose earpieces incorporate soft contoured black foam facings, which have been designed to sensibly swivel inwards, thereby facilitating their packing into a purse, satchel, or air travel bag.

A small rectangular aperture at the upper/outer lipped edge of each earpiece's external moulding caught my eye. Inside that aperture, ANVT have placed miniature microphones which monitor the external acoustical field, and extract the low frequency data to provide the active antiphase signal to attenuate, or (to use their words) 'reduce the noise' to which your ear would otherwise be exposed.

The headphones are connected by a 1100mm long 'Y' lead, at one end of which is an eight-pin miniature DIN plug, similar to those used by my Macintosh computer. This plugs into the active amplifier unit, which is comparable in size to a pack of 20 cigarettes. There are virtually no accessible controls other than the ON/OFF switch on one side of the unit, and a removable shirt pocket or belt clip at the rear.

The top of the amplifier unit has two sockets, one the eight-pin miniature DIN socket for the headphones, and the other a 3.5mm diameter 'tip, ring and sleeve' stereo phone socket. This matches the lead provided, for which a supplementary two-pin tip and sleeve socket is also provided to suit specific aircraft requirements (as typified by the Boeing 747, 767 and 737 aircraft of Qantas). As I subsequently discovered, not all aircraft provide these special sockets, and even when they do, they don't necessarily provide a signal which is compatible with the dynamic input signal range characteristics of the headphones.

On even closer inspection of the amplifier unit, you notice a battery compartment at its base, into which two standard 'AA' cells are easily inserted to provide a nominated 200 hours of useful operating life. Inside the lid of the box, ANVT provides 'A brief explanation of what you're about to experience'. This blurb extols the revolutionary active technology, but leaves it to the separate 'User Guide' to discuss the 'psychoacoustics experience'.

Stop Press: Version from Koss

Just as this article was being prepared for publication, we learned that leading headphone supplier Koss is now marketing its own version of the ANVT NQ100 active noise reduction 'phones. Called the Koss 'Quiet Zone 1000' system, these are likely to be available in Australia from existing Koss suppliers by the time this issue is published. A local price had not been finalised when we went to press.

For further information on price and availability, including your nearest dealer, contact the Australian distributor for Koss: EDS Trading Australasia Pty Ltd, of Slough Business Park, Unit 24, Slough Avenue, Silverwater 2141; phone (02) 647 2009.

I put on the NQ100's headphones, plugged in the lead, switched on the power, and — yes! I too knew exactly what the PR and Marketing people were referring to when they talked about that *psychoacoustic experience.* The sensation I observed was very much like walking into my anechoic chamber and closing the door.

My ears and brain became immediately aware of an abnormal sensation, in which the low frequency noise which all of us experience to varying degrees in our normal environment, was suddenly diminished in a most unexpected way. Whilst I wasn't sure that I was hearing an 18-decibel reduction in that level, I was sure that I was hearing a significant reduction. Having satisfied myself that the NQ100's do work, I then proceeded to evaluate just how well.

Objective testing

The first series of tests involved placing the NQ100's on one of my laboratory's 'artificial ears'. By far the most appropriate of these is the Bruel & Kjaer Type 4153 artificial ear. This provides a standardised test format, which virtually all headphone manufacturers have now adopted for the frequency response and related harmonic distortion evaluations of their products.

The 4153 uses a pressure response microphone, which provides an accurate and stable reference — even though it must be acknowledged that the combination of the type 4153 artificial ear and the preferred microphone do not duplicate the response characteristics of either the average human ear, or even any specific human ear. As I half expected, the frequency response testing on the NQ100's confirmed that their individual output frequency responses are reasonably flat over the frequency region 50Hz to 800Hz, with an unmistakable phase shift at 200Hz which manifests itself as a small peak followed by a trough. As I subsequently discovered, that phase shift occurs at the peak of the Active Attenuation characteristics, and is associated with the Active Attenuation algorithm which is incorporated in the NQ100's microprocessor circuitry.

The frequency response above 1kHz incorporates a significant number of fluctuations, the most significant of which occurs at 4500Hz. The frequency response does extend up to 20kHz as claimed, with significant fluctuations in the frequency response which is within +/-10dB from 15Hz to 20kHz. The useable frequency response is however more like 50Hz to 20kHz, with some of the more obvious perturbations in the high frequency response being directly attributable to the Type 4153 artificial ear's own characteristics.

An evaluation of the distortion characteristics of the headphones revealed some rather unusual characteristics. Unlike most other headphones, the total harmonic distortion at mid frequencies and high frequencies drops as the sound pressure level increases from 90dB to 100dB. At output levels which are typically in the range of 103dB to 105dB, the output amplifier circuitry appears to overload, and the distortion increases exponentially. This is the reason why the 'User Guide' states rather pointedly:

In some extremely loud environments, the NQ100 may overload and produce a static or crackling noise. If this condition persists, the unit should be turned off.

(It was only later that I discovered exactly what the blurb really meant, as I was fortunate enough to be wearing the NQ100's in an aircraft. When the pilot applied reverse thrust to slow down the aircraft following its touchdown, the extremely high levels of low frequency energy produced during that operation caused the NQ100's to overload. The resulting crackle and distortion was most unpleasant...)

Now an upper limit of a nominal 105dB sound pressure level is quite acceptable in almost any conventional aircraft, where the A-weighted sound pressure levels are generally less than 85 decibels, and the unweighted sound pressure levels are generally less than 95dB. But that upper limit on sound pressure level would not readily satisfy many other classifications of aircraft, as typified by helicopters and many light aircraft, whose cabins have not been designed to adequately attenuate propeller and engine noise.

So in practical terms, the NQ100's are designed for a specific, even if a somewhat limited range of uses, which the manufacturer has adroitly encompassed within the classification of 'for in-flight entertainment use on board US Air, Delta, SAS, Qantas, Singapore Airlines, and Alitalia aircraft'. This means that the NQ100's should not be used as hearing protectors in other very noisy environments, and particularly where the high sound levels are associated with significant high frequency noise — or where there are significant impact or high level transient noises, as typified for example by shooting.

Of course, if the dynamic output level range were to be increased, then subsequent versions of these noise-reducing headphones could undoubtedly be used for quite a few hearing conservation applications. However it should be clearly noted that the manufacturer's current literature cautions the user against using the NQ100's for such purposes.

I proceeded to measure the input impedance of the NQ100's, and was surprised to note that the impedance is remarkably flat. This is because what the input circuitry sees is an input load resistor with some parallel capacitance. The impedance is 3410 ohms at 63Hz, and only drops down to a value of 2950 ohms at 16kHz. These impedances match the requirements of in-flight entertainment systems, as well as most Walkman, Discman, DCC and battery operated TV sets with which they are likely to be used. As I discovered, they can also be used with portable transceivers, provided the peak external sound levels do not exceed 102 - 105dB.

Without a doubt, the most important objective test for the NQ100's is that of their noise attenuating or noise reducing characteristics. The efficacy of noise reduction, and the related measurements of the noise reducing parameters, are the fundamental reason underlying one's prospective purchase of the NQ100's.

These noise attenuation characteristics were evaluated using an acoustical test fixture (as specified by ISO/TR 4869-3:1989), which was placed in the middle of a large reverberation chamber. The levels at the test fixture's microphone were measured firstly with the test fixture microphone uncovered (unoccluded), and subsequently with the NQ100's in place and switched on.

The measured one-third-octave band noise reduction characteristics of the NQ100's are shown in the graph. Although the noise reduction characteristics are reasonably good, they neither approach the suggested 18dB attenuation, nor do they encompass the full 30 - 1400Hz noise quieting bandwidth claimed in the NQ100 User Guide. The best attenuation which I was able to measure was 16dB for the left ear, and 11dB for the right ear. An examination of the graph reveals that the effective attenuation starts at approximately 50Hz, and extends up to approximately 1200Hz.

A small proportion of the attenuation between 800Hz and 1200Hz is prospectively attributable to barrier screening effects of the headphone cups and foam. This characteristic is again observable at frequencies lying between 3000Hz and 10kHz, where the muff cups and foam facing provide useful noise screening for extraneous noise. There is however, a small region of negative attenuation, i.e., amplification of noise between 1600Hz and 2500Hz, similar to that which was observed with the Bose Aviation Head Set.

Listening tests

I was rather fortunate to find myself booked on an aircraft flight from Sydney to Adelaide, on the day following the completion of my objective performance evaluation of the NQ100's. As I sat myself down in my seat on the Boeing 737, I was delighted to find that the front of the seat's arm rest was equipped with two miniature tip-and-sleeve sockets, matching the plug adaptor in the NQ100's kit. But as I plugged in the lead, I was almost deafened by the level of sound which was fed through the headphones. Ouch!

My immediate response was to literally 'pull the plug', on what was proving to be an initially unpleasant experience. Then I checked the volume control on the seat arm, but discovered that I had already set it correctly to 'minimum level'.

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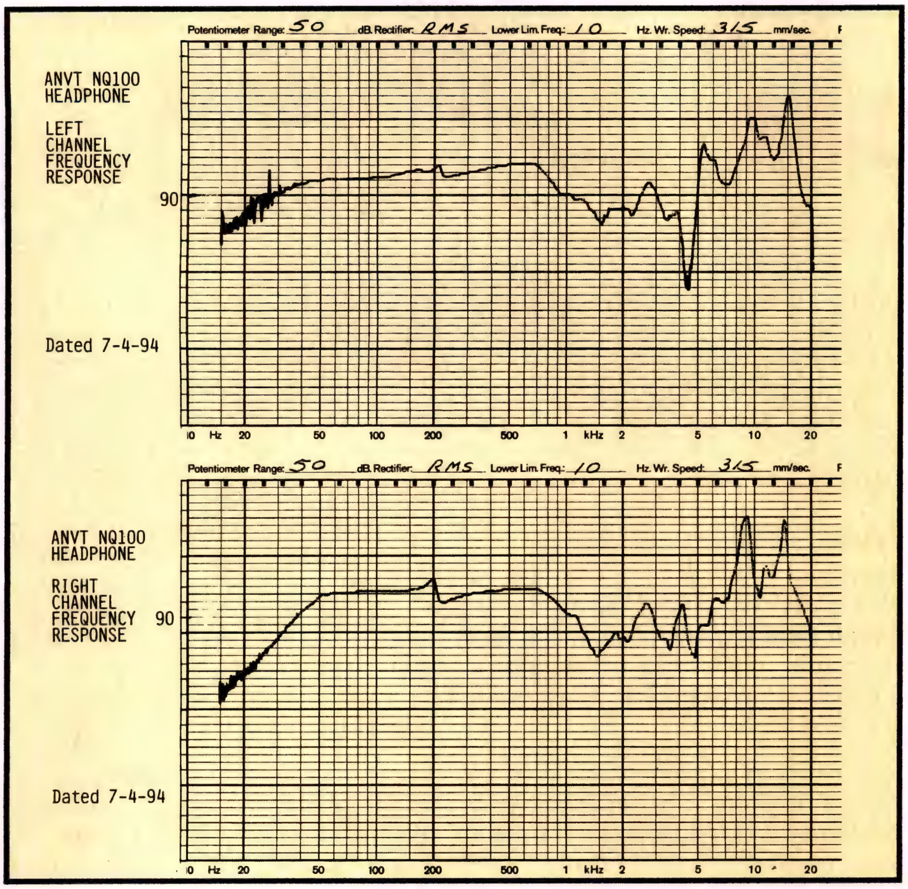

The measured frequency response plots for the noise reduction headphones, with the left channel at top and the right channel underneath. Again there are small differences between the two sides.

As I soon discovered, not all aircraft sound systems are directly compatible with the NQ100's. Whilst the literature cites Qantas as one of the airlines on which the NQ100's will work, this is only partly true. While Qantas 747's are quite suitable, that doesn't apply to their 737's, nor necessarily to any of their other aircraft.

Now as you might guess, I am not easily dissuaded by upsets like that, and so I persevered. I soon found that by plugging the adaptor only part of the way into the arm-rest sockets, I could pre-attenuate the input signal to an acceptable level. As soon as I had resolved what initially seemed to be an intractable problem, I became immediately aware of just how quiet the background sound level at my ears had become.

After listening to the 'in-flight' music with the NQ100 headphones, I carried out a series of direct A-B comparisons using the standard airline headset. I discovered that ANVT appear to have cleverly tailored the low frequency spectral attenuation, so that the noisiest and most intrusive components of the engine and external aerodynamic noise within the aircraft cabin were appropriately attenuated to the point to conform to what is technically known as the matching Background Noise Level (BNL) threshold of comfort.

I spent the next hour and a half listening to the sound track of the overhead TV monitors, oblivious to the insidious low frequency components of the aircraft cabin noise, and enjoying the sound and 'in-flight' entertainment to a degree which eclipsed any of my prior monitoring experience in any aircraft.

Summary

At US$199 (approximately A$288), the ANVT NQ100 Active Noise Attenuating Headphones are not just another status symbol for travellers, but really do constitute what I would classify as a 'must' for serious and frequent fliers.

They provide a simple and practical means of improving the quality of all forms of 'in-flight' entertainment — be it that provided by the airline, or your own, if you are one of those people who likes to take along your own Walkman or other portable music system.

Of course the NQ100's have other less obvious advantages, not the least of which is their ability to reduce the aural discomfort and related stress which many of us have previously regarded as a fundamental and inexorable (though unwanted) feature of overseas travel. ❖

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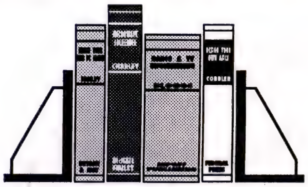


PC sound, music

WELCOME TO PC SOUND, MUSIC AND MIDI, by Tom Benford. Published by MIS Press, 1993. Soft covers, 234 x 180mm, 306 pages. ISBN 1-55828-316-1. RRP $39.95.

This is a somewhat different introductory book on using your PC for sound sampling and music making. Not because it comes with a companion CD-ROM disc (which is becoming increasingly common), but because both the book and the disc contain interviews with a number of leading US musicians with experience or expertise in the area of electronic music — people like pioneer guitarist/inventor Les Paul, film and TV composer Jay Chattaway, composer and recording artist Suzanne Ciani, and artists David Arkenstone, John Archer, Bob Fowler and Steve Branca.

Apart from the interviews, the book also contains an unusually large number of 'mini reviews' of currently available PC sound cards, external MIDI hardware, MIDI sequencer/editing software packages, and even PC games with noteworthy sound. These features, together with a good basic introduction to digital sound and MIDI, should make it of considerable value to anyone who wants to 'get into' sound and multimedia with their PC, but currently doesn't quite know where to start.

Along with the interviews, which can be played on a standard CD audio player, the CD-ROM disc included with the book has one track with PC software demo programs (including *Cakewalk*, *Mr Drumstix*, *PowerChords*, *Jammer21* and six from IBIS), plus an assortment of .WAV sound and MIDI music files (including a version of *The Nutcracker Suite* from Nautilus). So it all seems good value for money...

The review copy came from Australian distributor Woodslane, of Unit 8, 101 Darley Street, Mona Vale 2103; phone (02) 979 5944. (J.R.)

Maths for electronics

UNDERSTAND ELECTRICAL & ELECTRONICS MATHS, by Owen Bishop. Published by Butterworth-Heinemann, 1993. Soft cover, 190 x 245mm, 316 pages. ISBN 0-7506 0924 9. RRP $44.95.

To understand electricity, you really need a better-than-average grasp of mathematics. But if you study electrical or electronic theory at university level, a good knowledge of maths is more than essential; it's almost a way of life. If you can't understand the maths, you have little hope of understanding the theory.

This British book is aimed at the student who wishes he/she had paid more attention in the maths classes at school. The book is in two sections, and Part 1 deals with basic mathematical concepts such as numbers, quotients, logarithms, equations and graphs. Scattered throughout are 'test yourself' questions, with the answers in the back of the book.

The second part is more serious and gets into differential equations, Laplace transforms, *j* notation, Fourier analysis and so on. However, the book is not about mathematics for its own sake, it's about mathematics for the electrical/electronic arena. So you're not faced with learning material that has no relevance to the field.

The book uses several devices to make the subject matter more palatable. Headings like *An obvious example*, then *A less obvious example*, and boxes with the inviting title of *Explore this* or *Try this first* are scattered throughout. It's not so long ago that this sort of thing would have labelled a book as not being sufficiently 'serious' for university students, but this is the sort of book *I* would have loved, all those years ago when I grappled with the very stuff explained so well in this text. The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. (P.P.)

MIDI explained

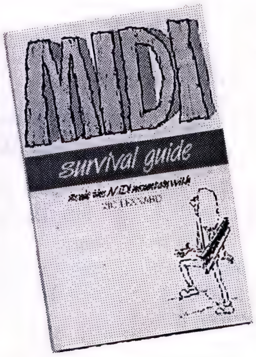
MIDI SURVIVAL GUIDE, by Vic Lennard. Published by PC Publishing, 1993. Soft covers, 218 x 135mm, 103 pages. ISBN 1- 870775-28-7. RRP $19.95.

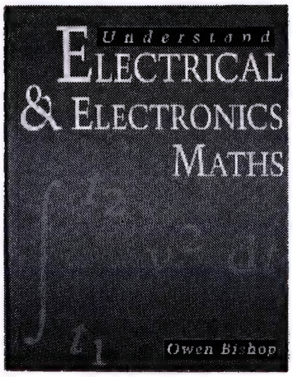
Even if you don't want to delve into the details of MIDI coding and system operation (and most of those using MIDI don't need to), hooking up an array of MIDI equipment and getting it to operate the way you want can be a big hassle if you don't understand at least the basic concepts. This book is designed to provide just those concepts, along with down-to-earth practical advice on what to look for in basic MIDI components, how to hook them up and get your system working properly.

The author is well known in the UK, as Technical Editor of *Music Technology* and *Home & Studio Recording* and with 300-plus articles under his belt. He was also founder of the United Kingdom MIDI Association (UKMA), so there's no doubt about his credentials to write this kind of book.

It's a very readable volume, with lots of helpful diagrams and an excellent balance between giving useful practical information and not baffling the reader with unnecessary theory. He even gives a handy rundown on General MIDI, and MIDI implementation charts.

As a friendly basic introduction to MIDI, you could hardly do better — especially at this price. The review copy came from distributor Astam Books, of 57-61 John Street, Leichhardt 2040; phone (02) 566 4400. (J.R.) ❖





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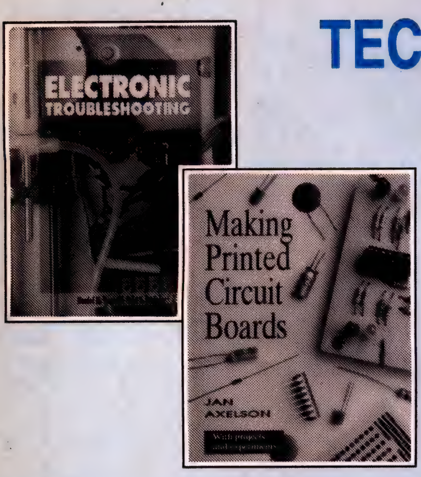

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SATELLITE RECEIVERS OFFER MANY FEATURES

Two new satellite TV receivers have been released by Paris Radio Electronics — the Winersat WR-3000, an easy to use model with manual tuning, and the fully programmable Geima GX- 6885. Both tune over the standard IF range and are compatible with standard LNB's for both Ku-band and C-band reception.

by JIM ROWE

Despite delaying tactics by the 'powers that be', Pay TV is inevitably drawing closer for Australia. And although it now seems likely that the first official service to operate may use a cable distribution system, it's still very likely that direct satellite reception will ultimately form at least one of the options for subscribers.

In any case, there are many satellites either already in orbit in this area, or projected to begin broadcasting in the next year or two — with footprints which include Australia. So that one way or another, a satellite receiver is likely to provide access to quite a lot of interesting programmes, in the next few years — whether of the 'free to air' or 'paid for' varieties, or both.

Small wonder, then, that the local market for satellite TV receivers is steadily 'warming up', as both consumers and suppliers recognise the potential benefits. Along with the market for antenna dishes, LNB's, IF splitters and so on, of course.

The latest firm to begin marketing satellite equipment is Paris Radio Electronics — better known for its expertise in radio communications and weather satellite reception systems, and also for the 'Ultimeter II' Home Weather Station, reviewed in our February 1994 issue. Pictured are two of the firm's satellite receivers, the Winersat WR-3000 and the Geima GX-6885.

Manual model...

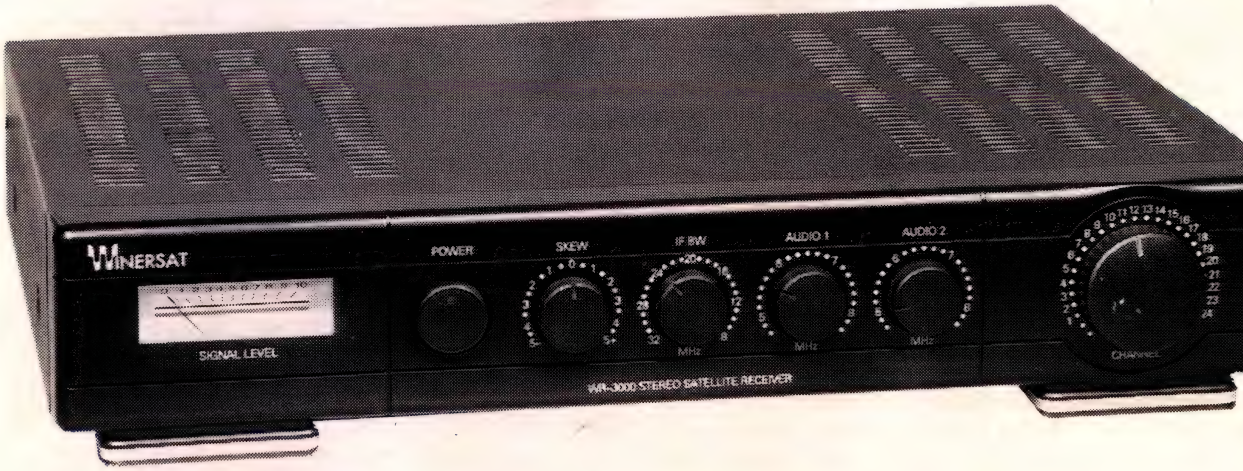
The Winersat receiver offers manual tuning, with continuous coverage of the standard 950 - 1450MHz band used as the first IF in satellite TV reception. (The LNB's used for both Ku-band and C-band reception are designed to convert the incoming signals down into this range.) A large control knob is provided for tuning, with a circular scale marked 'Channels' and '1 - 24'. To facilitate convenient tuning for optimum reception on each received carrier, there's also a signal level meter.

In keeping with the straightforward 'manual' orientation of this receiver, it also has front-panel manual controls for second IF bandwidth adjustment, tuning of the two stereo audio subcarriers and feedhorn/LNB skew adjustment.

The bandwidth of the 70MHz second IF channel can be adjusted continuously from 8MHz to 32MHz, which is more than adequate to allow optimum reception of either 'full transponder' or 'half transponder' signals. Similarly each audio subcarrier channel can be tuned continuously from below 5MHz up to approximately 8.5MHz, to cope with most standards in use for satellite broadcasting. The LNB skew setting can be adjusted over a 10° range (+/- 5°), with a switch on the rear panel providing the larger 90° change needed to switch between vertical and horizontal polarisation.

Also provided on the rear panel is an audio IF bandwidth adjustment, to allow optimum reception with different FM deviation standards. The control provides continuous bandwidth adjustment between 110kHz and about 280kHz, again giving a high degree of flexibility. There's also a screwdriver-adjusted control to set video output level.

The WR-3000 provides +18V DC via the IF input connector, to power the LNB. It has a rated input level range of from -60dBm to -30dBm, with the standard 75 ohm input impedance. Outputs provided include video, baseband (to drive an external decoder) and the two stereo audio outputs, plus a fairly standard trio of connectors for driving a



pulsed mechanical polar rotator: +5V, 'Pulse' and GND.

In addition to the direct audio and video outputs, the receiver also provides a PAL-B modulated VHF output to drive a standard TV set, via an inbuilt RF modulator. The modulator can be switched between VHF channels 3 and 4, and there's also an 'ANT IN' connector to allow the satellite receiver to be looped into the normal antenna lead.

Rated video bandwidth is 50Hz - 5MHz, with a signal to noise ratio of 45dB for 12dB C/N (carrier/noise ratio). The video de-emphasis conforms to the CCIR recommendation 405-1, and the video output level is 1V p-p into 75 ohms. The baseband output level is 0.7V p-p. The receiver's signal recognition threshold is given as typically 8dB C/N.

On the audio side, the rated frequency response is 30Hz - 15kHz, with 50us de-emphasis. Signal to noise ratio is 50dB at 75kHz deviation, with 0.25% THD. Output level is 1V RMS into 10k.

Choice of demodulator output polarity for Ku-band or C-band operation is via an internal PCB link, by the way, although it could easily be brought out to a rear-panel switch if desired.

In short, then, the WR-3000 is a real 'enthusiasts' satellite receiver, with a great deal of operating flexibility but the emphasis on fully manual control. For the quoted price of $329.95 plus tax it seems good value for money.

...or programmable

In contrast, the Geima GX-6885 receiver is for the satellite TV viewer who wants to be able to set everything up, and then simply switch channels instantly via a remote control.

This receiver is of the fully programmable, microprocessor controlled variety, with full memory storage of all setup information for up to 100 channels.

It also features autoscanning and auto channel memory to simplify setting up, and all information is displayed on the screen of your TV receiver.

Like other fully programmable receivers, operation is primarily controlled via a handheld IR remote unit. The front panel of the receiver itself is very plain, with only three controls: a power/standby button and Up/Down channel select buttons — presumably for when you can't find the remote unit. The only other items on the front panel are four LEDs, indicating respectively 'Stereo' (audio), 'Power', 'Scan' and 'IR' (which blinks to confirm the detection of commands from the remote).

On the other hand the remote unit has 15 control buttons, to allow a wide range of user setup and adjustment. Apart from a Power key, used to switch the receiver on, there's again a pair of Up/Down channel keys — plus a numeric keypad to allow direct entry of a new channel number (or a transponder tuning frequency).

There's also an audio muting key; a Scan key; a CFM key for automatic setup scanning; a PGM key to call up an on-screen menu for detailed manual adjustment of channel programming data; a Setup key, for selection of programming data; a Normal key, to remove on-screen displays; an LNB key, to display LNB information; an Audio key, for temporary over-riding of audio setup data; a Timer key, for programming an inbuilt timer (using Setup); and a pair of Store keys, which are pressed together to save a channel's set-up information in memory.

On the rear of the GX-6885 there's an almost bewildering array of connectors. Apart from the IF input from the LNB, and the usual video/baseband/stereo audio RCA outputs, there's also a pair of SCART sockets (one for an external decoder, the other for your TV); a pair of 'Ant In' and 'RF Out' connectors for RF interconnections (the internal PAL VHF modulator can again be set for either of channels 3 or 4); spring connectors for driving a magnetic polar rotator at the LNB; and a trio of video/stereo audio inputs, as this receiver allows some channels to be programmed for display of external AV signals.

Also on the rear panel is a second small slider switch, used to change the video demodulator polarity configuration for Ku-band or C-band operation, and a 'CVBS' logic output (presumably for decoder control).

The GX-6885 tunes over an extended IF input range, from 950MHz to 2000MHz, to allow for a greater choice of transponder frequencies. The basic channel tuning can be programmed in 1MHz steps, but finer allowance for LNB oscillator offset can be made in 0.5MHz steps (over a +/-10MHz range) when the LNB data is programmed.

Each memory channel can be programmed for channel frequency (IF), polarisation, decoder, AV input, second IF bandwidth (18MHz or 27MHz), video contrast (four adjustment steps), and audio mode.

There are 19 inbuilt preset audio demodulation modes available, and these cover just about all of the mono/stereo subcarrier combinations in common use. In any case, the IR remote's Audio key can be used for over-riding the stored data to find a more appropriate setting, during viewing.

The separate LNB setup mode allows

programming of nominal local oscillator frequency, vertical and horizontal polarisation skew (each has 64 adjustment steps) and oscillator offset as mentioned earlier. The polarisation current adjustment range is +/-60mA.

The GX-6885 provides 17V DC to the LNB when set for horizontal polarisation and 13V DC for vertical polarisation, to suit voltage-controlled dual polarity LNB's. It is designed for an input IF level between -65dBm and -25dBm, and has a typical signal recognition threshold of 6.5dB C/N.

The second IF is at 479.5MHz, and it has a typical image rejection of 50dB. Video de-emphasis is according to CCIR 405-1 and both the video and baseband outputs are 1V p-p. The baseband frequency response is quoted as DC - 10MHz. The rejection of energy dispersion modulation (not often quoted) is specified as greater than 40dB.

On the audio side, IF bandwidth is given as 150kHz with a frequency response of 50Hz - 16kHz (-3dB). The audio output level is 0dBm into 600 ohms.

From this description it should be fairly clear that the GX-6885 receiver is designed to offer a high standard of performance for the less technical satellite viewer.

A different segment of the market from that addressed by the WR-3000, of course, and no doubt one that will ultimately be much larger. Despite this the quoted price for the GX-6885, complete with remote control, is not all that much higher at $399.95 plus tax.

Trying them out

Paris Radio Electronics loaned us samples of both of these receivers for a few days, and we were able to try them out with our existing 1.8m dish and 1.05dB phase-locked loop LNB, plus a TV receiver with direct AV inputs.

In the time available we were only able to tune into the 'fortuitous PAL' signals on the Optus B1 satellite transponders, but both receivers gave excellent reception and every indication that they met their quoted specs.

Needless to say the two were rather different in terms of operation, as you would expect. The WR-3000 manual receiver was rather easier to get going initially, although we did have to open up the case and change over the internal demodulator link (because it had been set up for C-band operation). Once this was done, though, setting it up for any desired transponder was quite straightforward.

Thanks to the receiver's flexibility it was also easy to optimise reception; although when you want to changeto a different transponder, everything has to be set up manually again.

On the other hand the GX-6885 receiver with its fully programmed operation was somewhat more involved to set up initially, but once set up it's much easier to change transponder channels.

Summarising, then, the WR-3000 manual receiver is very much a set for the satellite TV enthusiast who wants convenient and continuous control over reception, while the GX-6885 programmable model is more for the non-technical viewer who wants to 'set it and forget it'.

Further information on both receivers is available from Paris Radio Electronics, 161 Bunnerong Road, Kingsford 2032; phone (02) 344 9111. ◆

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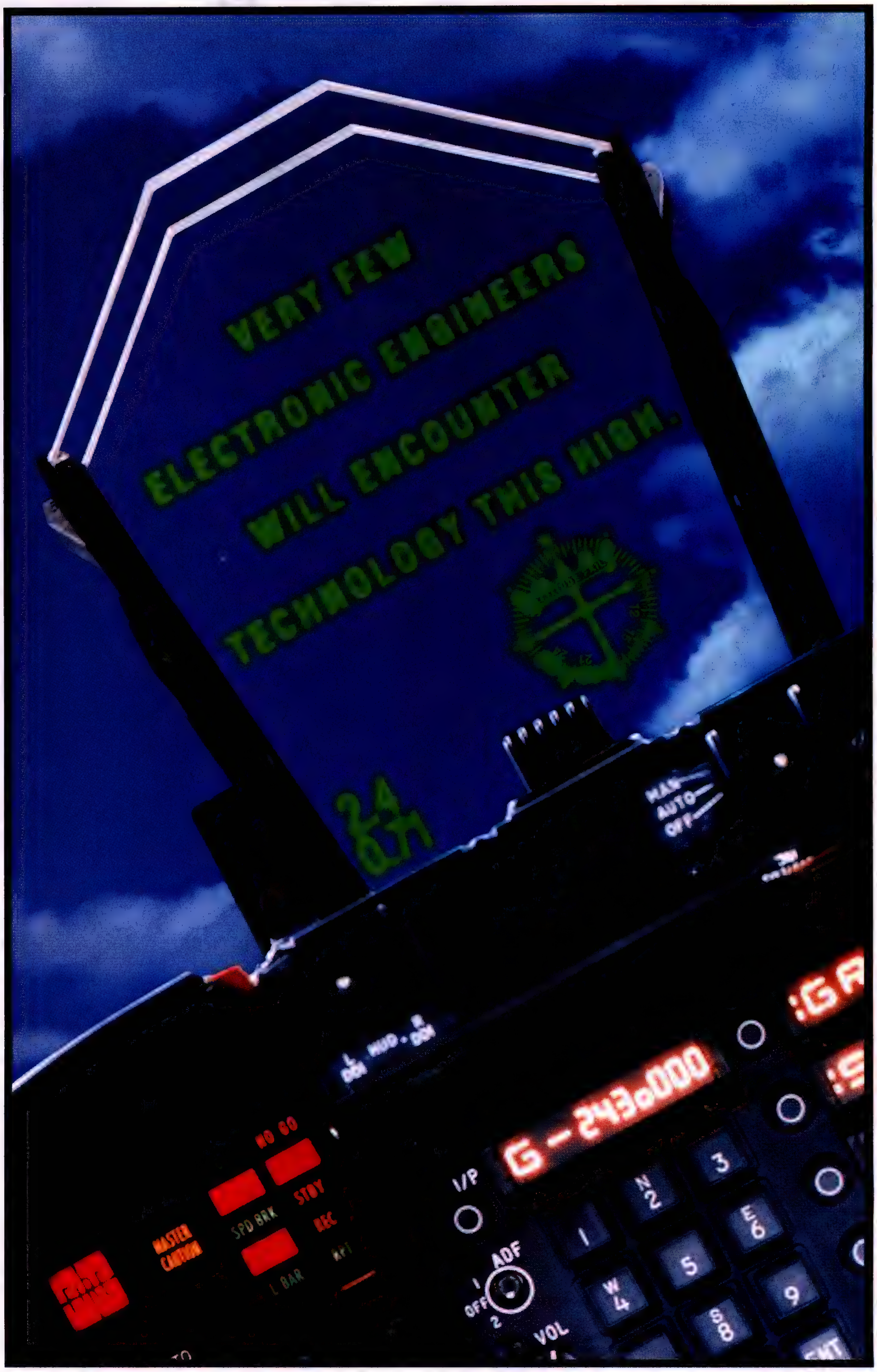

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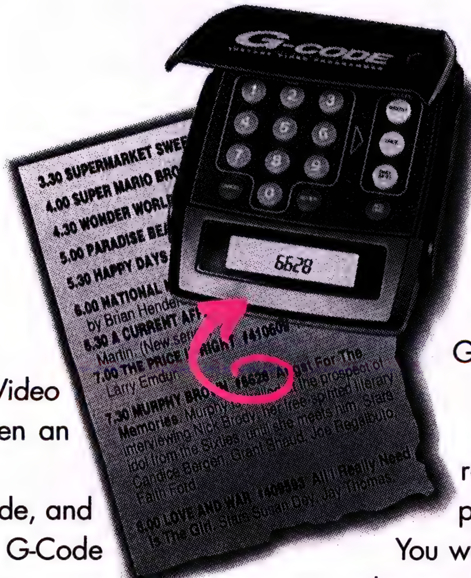

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An Intelligent Listener's Guide to

UNDERSTANDING THE SHORTWAVE RECEIVER - 1

Many modern shortwave receivers are capable of very high performance, but can also provide an array of controls and dials which can be quite bewildering for the newcomer. It's also easy to be confused about which aspects of receiver performance are really important, and which are less so. Here's the first of two articles in which Tom Moffat shows you not only how to pick the right receiver for your needs, but also how to get the best from the receiver when you're using it.

by TOM MOFFAT, VK7TM

What a wondrous thing is the modern receiver. You can hear what someone is saying on the other side of the world, just by turning a dial. You can intercept propaganda broadcasts destined for anyone who will listen, or you can sometimes snare a national secret which the originator would certainly prefer you not to hear.

Most of us think of a receiver as a box with some knobs and a speaker on the front and an antenna connector on the back. We turn on the receiver and it does its thing. It's a bit like that old song about the jukebox: 'You puts your money in, the music goes round and round, and it comes out here'.

Not all communications receivers have as many controls as Icom's top of the range IC-R9000, which is perhaps just as well. But even less expensive models can be confusing...

But life is not that easy. Within the receiver some amazing things take place. You might hear a five-watt transmitter, weaker than a bicycle headlight, broadcasting from the other side of the world. That five watts from, say, England, might radiate out all over the globe, and by the time it gets to Australia, it will be microwatts, or nanowatts. Pretty small, anyhow. Yet a voice can come blaring out of the speaker as if it's sitting right next to you...

In this first article we will explore the things that let your radio pick out one signal from all the others bouncing around the world. It is not just esoteric theory, and we will be using an Icom R71-A receiver as a practical example. If you claw your way through what follows you will be able to make an informed judgment about what kind of receiver you need, and you will have a fair idea of what actually happens when you turn those knobs and switches.

Next month we will look at 'real' receiver examples, and discuss practical ways to optimise a received signal through intelligent use of a receiver's controls. We will also examine an antenna especially for urban dwellers who live in noisy areas.

But for now — grit your teeth, fasten your seat belts, and let's get technical.

The matter of gain

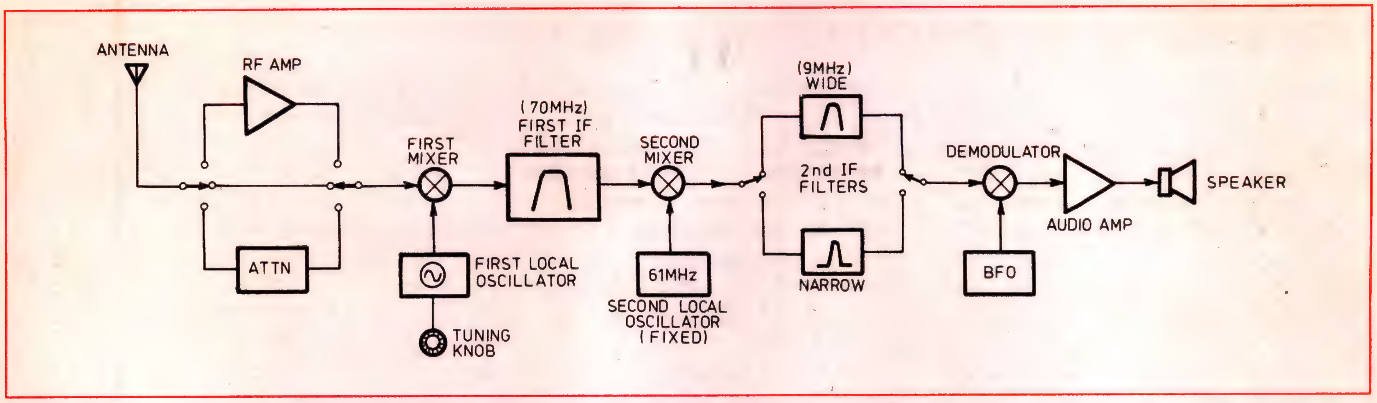
Logical thinking would have it that the more sensitive a receiver is the better it's going to work, and the more gain it has, the more sensitive it is. Both these assumptions are wrong. Signal-to-noise ratio is what's important, not sensitivity. And we want good *dynamic range*, not lots of gain.

The first stage in most VHF receivers is an RF amplifier, usually a low noise transistor such as a FET (field-effect transistor), which is designed to amplify whatever is coming from the antenna as much as possible while adding minimum noise of its own. This is followed by a mixer, and then the first IF (intermediate frequency) amplifier. The IF amplifier may consist of several stages, having an enormous amount of gain when combined together. Such an arrangement has it all; excellent sensitivity from the RF stage, and lots of gain from the IF stages.

This is the way to go in a receiver to be used on VHF or UHF frequencies where there is very little noise from the antenna, and signals may be quite weak. But a similar receiver design on the shortwave bands wouldn't be worth the gunpowder to blow it to hell.

On HF we have NOISE. Whizz-burr-pop-pop-pop. We have static. Crash-bang. We have power lines going buzzzzzz. We have million-watt transmitters and local broadcast stations going babble-babble-babble. This is all coming into the antenna; it might be on different frequencies, but it's all there. And buried down inside it all is a little 10-watt transmitter in Lower Slobbovia that you would dearly love to hear.

So if you tune to the correct frequency, select maximum sensitivity, and wind up the gain, all you get is all the above noises, combined together, and badly distorted to boot. The reason is that in any amplifier, be it for audio or



The basic block diagram for a typical modern communications receiver, using a double-conversion superhet configuration with a 70MHz first IF and 9MHz second IF. Note the selectable RF amplifier and attenuator at the front end.

radio use, there is a limit to the size of the signal it can deal with. Anything bigger simply crushes against the top, flattens out, spreads, and becomes violently distorted. If this happens to two or more big signals at once they will mix together, producing even more rubbish than the sum of their individual parts.

These big signals may be far removed in frequency from the one you're trying to hear, but they will still make their presence felt as low-level babbling, gurgling, and hissing. It might not be strong, but if it's stronger than the weak signal you're trying to hear, you'll never know the weak one is there.

Perhaps now is the time to introduce 'the box'. It's a way I've worked out to visualise these problems, and the solutions to them. Have a good long look at Fig.1.

Vertical distance within the box represents signal strength. Horizontal distance represents frequency. The centre of the box represents the frequency the receiver is tuned to. To the left of centre are lower frequencies, to the right are higher frequencies This particular box is 100kHz wide (-50 to +50), similar to the early stages of a receiver.

Now, here is a very important concept: the height of the box is fixed; there is nothing you can do to adjust it. The height is determined by the receiver's design, and is known as its *dynamic range*. The only thing you can do to change it is buy a new receiver. The better the dynamic range, the better the receiver.

The dynamic range is expressed in decibels (dB), which is the ratio between the biggest signal the receiver can handle and the smallest signal it can receive before it gets lost in the noise. I have scaled the left side of the box up to 110dB, which would be just about the best dynamic range available anywhere. Both of my own Icom receivers have a dynamic range of 105dB. This is shown by a flat gray surface at the 105 mark. I have also owned radios with dynamic ranges of less than 60dB. Here you lose half the box!

The box, as you see it in Fig.1, is much like the display on an instrument called a 'spectrum analyser' which plots the strengths of radio emissions against frequency. At the bottom of the box is some fuzzy stuff that looks like grass. On a proper spectrum analyser this display is called (wait for it) grass! It is a very apt term, especially if the display tube is green.

The grass represents random noise coming in through the antenna, as well as noise generated by the receiver itself. If you disconnect the antenna, then whatever noise is left is known as the *noise floor*. The top of the box is called the 'ceiling'; in our box the ceiling is at 105dB, with the grass at 0dB. The space between them is the dynamic range.

Those pillars within the box represent signals; the higher the pillar the stronger the signal. Let us pretend for the moment that the pillars are made of glass. The one in the centre is the signal we would like to receive, but it is very small compared to some of the others. One's immediate reaction would be to crank up the receiver's gain to make the desired signal bigger; but this would make all the others bigger too.

Soon we would reach a point where

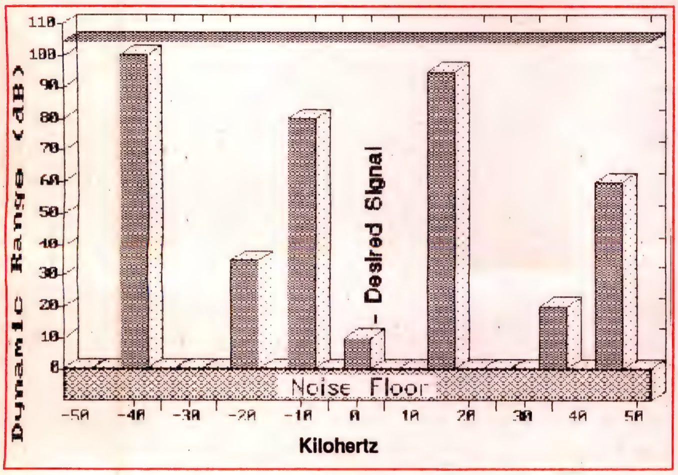


***Fig.1:** The author calls this diagram 'THE BOX'. It illustrates what is meant by receiver terms 'noise floor' and 'dynamic range', as well as 'grass' and 'ceiling'.*

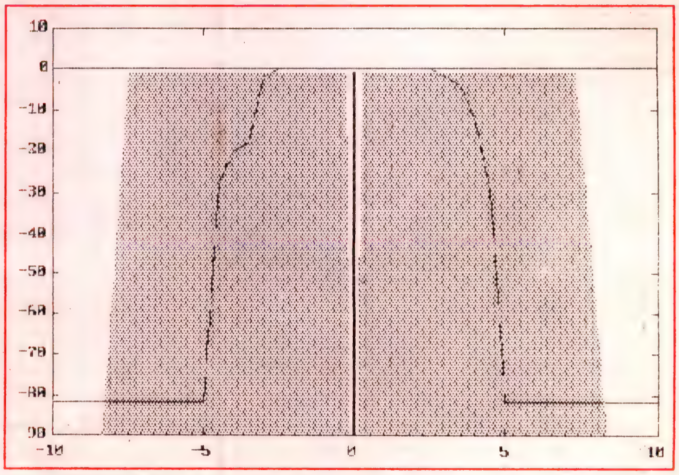


***Fig.2:** When the normal or 'wide' IF filter is used with a standard AM signal, it allows most of the AM sideband information to be heard — for high intelligibility.*

the largest signal hits the top of the box, the ceiling. Being made of glass, that big signal would then shatter, falling in broken bits all over the 'noise floor'. This would, of course, increase the depth of the rubbish there, raising the 'noise floor' higher. If we keep increasing the gain further, another signal will soon hit the ceiling and shatter, scattering even more noise over the floor. I know this is a rough-and-ready analogy, but it should get the point across.

To look at it another way, say you are standing in a large room pointing a stream from a fire hose at the ceiling. There isn't enough pressure for the stream to reach the ceiling, so it just arcs up and then down again. But if someone revs up the pump and increases the pressure, the stream will hit the ceiling and then splatter everywhere — totally out of control, making a mess of everything else in the room.

By the way, hitting the ceiling, in radio terms, is known as 'splatter'.

In a real-world receiver, there is a circuit known as the AGC (automatic gain control) which adjusts amplifier gain so that the signal we are trying to receive is set to a sufficient level where it can be easily demodulated. However unwanted signals will be amplified as well, and big ones may smash into the ceiling if the receiver's dynamic range is inadequate.

Bandwidth

Bandwidth refers to the entire spectrum of signals that is entering a particular part of a receiver at any one time. In any shortwave receiver the bandwidth at the antenna input is the entire radio spectrum; LF, MF, HF, and even VHF, with the only limitation being imposed by the antenna itself. If you use a 'broadband' antenna the receiver is hit by giant signals from local AM broadcast transmitters, powerful shortwave stations such as Radio Australia, and sometimes FM and TV signals. All these signals are doing their best to mask some tiny station from the other side of the world that you may want to listen to.

Many large signals can be got rid of before they cause any damage by the use of a *filter*. The effect of a filter is to make our 'box' narrower. In the case of the Icom R-71A receiver, there is a selection of filters that can be connected directly between the antenna and the rest of the radio. Which filter is used is determined automatically by the radio's microprocessor as it tunes across the spectrum. For instance one filter passes only signals between 22 and 30MHz. Another covers 15 to 22MHz. One filter is dedicated solely to the AM broadcast band; another passes only LF, 100 to 500kHz.

The filter at the antenna rejects an enormous part of the unwanted spectrum, but there can still be a chunk of spectrum (the 'box') up to 8MHz wide, which the receiver has to contend with. And anywhere within that range there can be one or more big signals, doing its best to smash into the ceiling.

As mentioned above, most receivers have an RF amplifier to maximise the receiver's sensitivity to weak signals. Trouble is, if the RF amplifier has a gain of 10dB, every signal within its bandwidth (within the box) is moved 10dB higher up the scale toward the ceiling. Some may hit it, shatter, and mask the desired signal with extra noise.

In some receivers such as the R-71A, there is a front panel switch that bypasses the RF amplifier, in effect replacing it with a simple piece of wire. If there is still an *overload* problem (signals hitting the ceiling) with the RF amplifier removed, you can switch in an *attenuator* to move all the signals a further 20dB down the scale, further from the ceiling.

Of course by now the signal you want to receive has also been reduced 30dB below what it would have been with the RF amplifier in use. So it is certainly desirable to have the ceiling as far above the noise floor as possible. Such is the importance of *dynamic range*.

Within the receiver common practice is to feed the signal, either via the RF amplifier, the attenuator, or the piece of wire, into a *mixer*. This is simply a circuit which subtracts (or sometimes adds) two frequencies to produce a third frequency. One source frequency comes from the antenna, and the other from a *local oscillator* which is controlled by the radio's tuning knob.

To listen to the WWV time station on 10MHz, you would inject a local oscillator frequency of 80MHz. The *first IF* (Intermediate Frequency) would then be 70MHz (this is in fact the first IF frequency in the R-71A receiver). There would also be the sum of 80+10 = 90MHz, an unwanted 'product' known as an IMAGE. This is got rid of rather smartly by sticking a 70MHz *bandpass filter* right on the output of the mixer. This filter has also dramatically narrowed our 'box'.

Here is a very important point: modern high-quality receivers use what is called a *double-balanced mixer*. This

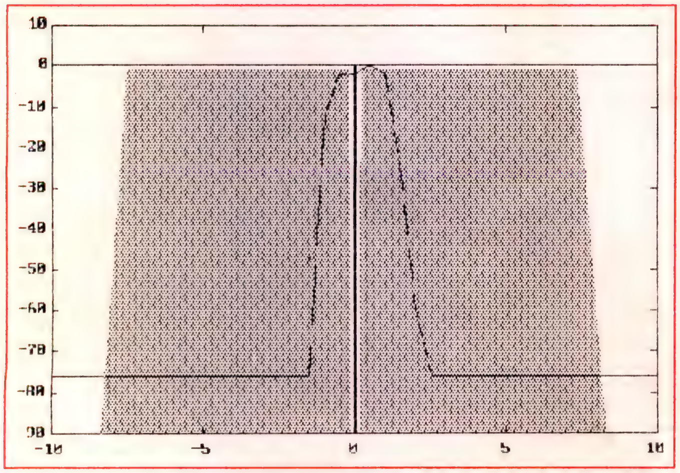


Fig.3: When the receiver's 'narrow' IF filter is used with an AM signal to remove interference, it also removes most of the sideband information — reducing intelligibility.

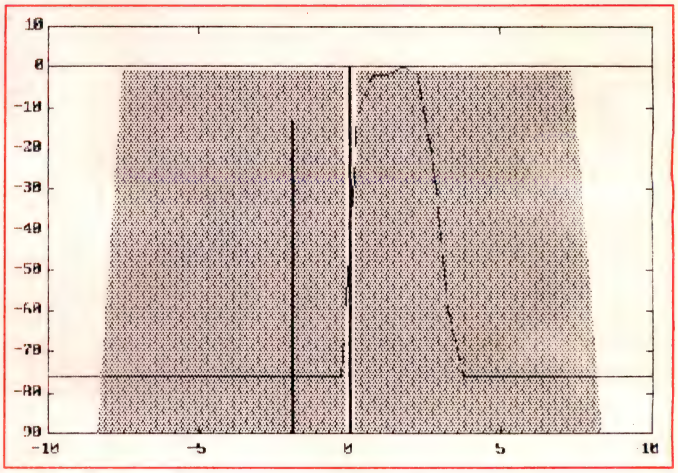


Fig.4: Because only one sideband is needed to convey all of the modulation information, the 'narrow' filter can be used to select the sideband which does not have interference.

may be a carefully-designed pair of transistors, or in the ultimate case, simply a transformer and diode arrangement with no active components at all.

The double-balanced mixer has excellent dynamic range. It is very difficult to overload a double-balanced mixer. So the best dynamic range, combined with good sensitivity, will occur when the signal from the antenna is fed *straight to the balanced mixer*, with the RF amplifier bypassed. This is the configuration I always select unless there is a good reason to do otherwise. More on this next month when we discuss receiver operation.

Another very important point: The local oscillator that feeds the mixer must be as *pure* as possible; that is, it should generate a perfect sine wave. If the local oscillator output is distorted, it in effect consists of more than one frequency. We thus have two local oscillators working into the one mixer at the same time, causing the receiver to respond to two parts of the spectrum at once. We may end up with our signal plus one or more undesired signals, or just extra noise if there are no signals on the extra received frequencies.

In the very best receivers, a lot of effort goes into making the local oscillators as pure as possible. This is sometimes done with a very high-quality circuit known as a *direct digital synthesiser* or 'DDS'.

The first IF, then, consists of a fairly narrow block of frequencies, a few kHz wide, which are fixed about a central point. Should there be an on-air signal on 10.005MHz, this will turn up in the first IF at 70.005. An incoming signal on 9.996 would be in the first IF at 69.996MHz. The important thing to note is that all of these first IF signals are 'strapped down to the table', fixed in frequency, where they can be operated upon with surgical precision.

Should we decide to listen to the signal on 10.005MHz instead of WWV on 10.000MHz, we would move the tuning knob so that the local oscillator became 80.005MHz. The new station would then be on 70MHz, smack in the middle of the first IF. WWV would be in the first IF at 69.995, and the signal originally on 9.996 would be in the first IF on 69.991, possibly already being rejected by the 70MHz filter.

Current filter technology is such that it isn't easy to produce a 'surgical precision' filter on 70MHz, but for many years receiver designers have been making fancy crystal filters for lower frequencies. A standard seems to have evolved at 9MHz, so we convert our signal down there now, with the help of another mixer, fed by a second local oscillator fixed on a frequency near 61MHz (70-61= 9MHz). Since this is the second frequency conversion the desired signal has undergone, 9MHz is known as the *second IF*.

IF filters

At this stage the second IF is exactly like the first IF, except that the frequency of the 'box' and all signals within it has had 61MHz subtracted from it. We can now use a specialised IF filter, or even a collection of IF filters, to cleanly slice from the box the signal we want to listen to, and leave all the others behind. And (BONG-BONG! WAKE UP AND LISTEN! HERE COMES THE GOOD STUFF!) we can even lift out *parts* of signals.

Since we're talking about 'parts' of signals, we'd better look at what signals are made up from. In the case of a good old-fashioned AM signal, there is the carrier and the two sidebands: upper and lower. The sidebands are generated by the modulation process (a form of mixer, as above). Two signals are fed into the modulator, the carrier and the audio, and what comes out are the carrier, the audio, the carrier plus audio, and the carrier minus audio. If the carrier frequency is 10MHz, and the audio modulation frequency is 1kHz, then the modulator (mixer) products are 1kHz, 10,000kHz (10MHz), 9999kHz, and 10,001kHz.

Since the output of the modulating mixer is tuned to the 10MHz transmitter frequency, the 1kHz audio component quickly disappears, leaving the carrier, the lower sideband, and the upper sideband — classic AM. If the modulation is music or speech, instead of a 1kHz tone, there will be sidebands representing every audio frequency present, with each note played producing an upper *and* lower sideband spaced away from the carrier by its pitch (high notes further from the carrier).

In international shortwave broadcasting the modulation frequencies are limited to 5kHz or so, lopping off any sidebands further than 5kHz from the carrier. In local AM broadcasting, modulation frequencies up to 10kHz are permissible.

Now, if the mixer you use for modulating the carrier happens to be of the double-balanced variety, the audio and the carrier are not reproduced in the output and all that's left are the two sidebands. Both of the sidebands contain exactly the same modulation information, so it's quite feasible to use a filter to remove one of them. What's left now, of course, is SSB or *single-sideband* transmission. Which sideband is removed is of little consequence. The

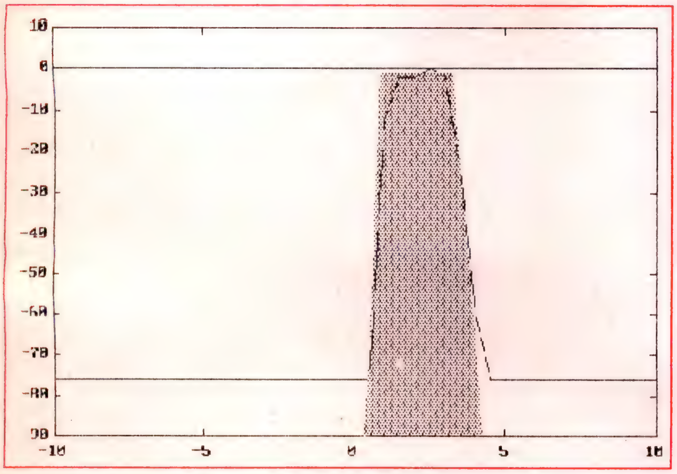


Fig.5: When the 'narrow' filter is used with an SSB signal, there is an almost perfect match — virtually all of the modulation information is allowed through.

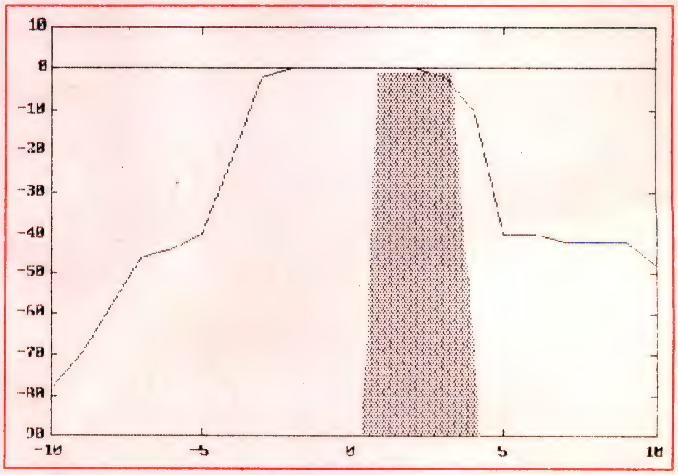


Fig.6: A portable receiver like the Sony ICF-SW7600 generally has a relatively wide IF response, as shown here. This makes it poor at selecting narrow SSB signals.

resulting signal is known as LSB (lower sideband) or USB (upper sideband).

The advantage of SSB is that it uses less than half the bandwidth of an AM signal conveying the same information, and 1/4 the power is required to do the same job. The disadvantage is that since no carrier is present, the receiver cannot *de*modulate it (another form of mixing) unless it generates and re-introduces a 'fake' carrier of its own. The device to do this is known as a BFO (beat frequency oscillator). SSB reception is impossible without a BFO.

Righto, let's look at some real filters. Fig.2 is an actual plot of the frequency response (bandwidth) of the 'wide' filter in an Icom R-71A receiver. Note that the plot is not entirely symmetrical. No filter is perfect. The filter is superimposed upon a signal of the type you might find on the AM broadcast band. The heavy line in the centre is the carrier, and the shaded areas to the left and right are the lower and upper sidebands. These extend in each direction from around 100Hz to 8kHz from the carrier. So the frequency response of the transmitted signal is from 100Hz to 8000Hz — not bad for an AM broadcast signal.

The filter, however, chops off any sidebands further than 5kHz from the carrier. So the filter in this receiver limits the frequency response to 5000Hz, not the full 8000Hz. However signals on the international AM broadcast bands, where sidebands are limited to 5kHz, would fit within this filter nicely. Providing there is no interference, stations will produce good audio quality for both speech and music.

Note we said 'if there is no interference'. Almost always on the shortwave bands, and often on the AM broadcast band at night, two signals are trying to occupy the same space. On the shortwave bands, stations are usually placed 5kHz apart. But if each of them is modulating with audio frequencies up to 5kHz, then each will have sidebands extending 5kHz either side of the carrier. If there are two transmitters 5kHz apart, the upper sideband of one will be occupying the same spectrum space as the lower sideband of the other. The result is that both stations suffer bad interference from each other, and both are very unpleasant to listen to.

The obvious solution is to select the receiver's 'narrow' filter instead of the wide, in an attempt to mask out the interference. This has been done in Fig.3, which is a plot of the response of the narrow filter in an Icom R-71A receiver, superimposed on the same AM signal as in Fig.2. We have certainly reduced responses from the sides, but by pruning the sidebands we have also chopped off all audio frequencies above a few hundred Hz.

If you stick an old sock in your mouth, plug your nose, and then count to 10, you will get an idea of what this filter sounds like. So if you've ever wondered why your radio sounds awful when you hit the 'narrow' button, now you know.

But all is not lost. As we said earlier, only one sideband is needed to carry the modulation information. So the trick of separating the interfering signals is to select the upper sideband of the higher station, or the lower sideband of the lower station, and reject the un-needed (and interfered with) sideband. This is being done in Fig.4.

Many radios have an 'IF Shift' or 'Passband Tuning' (PBT) control, which lets you effectively slide the filter up and down in frequency. In Fig.4, as well as the desired station's carrier, there is another unmodulated carrier a couple of kilohertz lower in frequency and nearly as strong as the station we are tuned to. If we were using the wide filter as in Fig.2 the two carriers would 'beat' together, producing a loud audio whistle of 2kHz, the difference between their frequencies. The station would be unlistenable.

However if we carefully shift the filter higher, we come to a point where the desired station's carrier is near the edge of the filter response, and the rest of the filter is filled with upper sidebands. The resulting audio is not 'hi-fi', because the upper edge of the filter cuts out all frequencies above 2.5kHz or so. But you can now listen to a station that was formerly useless.

Note that the carrier MUST be included within the filter, otherwise all the receiver sees is a single sideband signal with no carrier, and this is impossible to demodulate in the AM mode. In receivers without IF shift, it is possible to receive AM stations in the SSB mode, which automatically pushes the filter to one side. This will be explained next month.

Single sideband, of course, is what the narrow filter is primarily intended for. In most receivers the narrow filter is automatically chosen when you switch to USB or LSB mode, and it's automatically shifted to select the appropriate sideband. Fig.5 shows this situation — an upper sideband signal, no carrier, with the R-71A's narrow filter sitting squarely on top of it. It is almost a per-

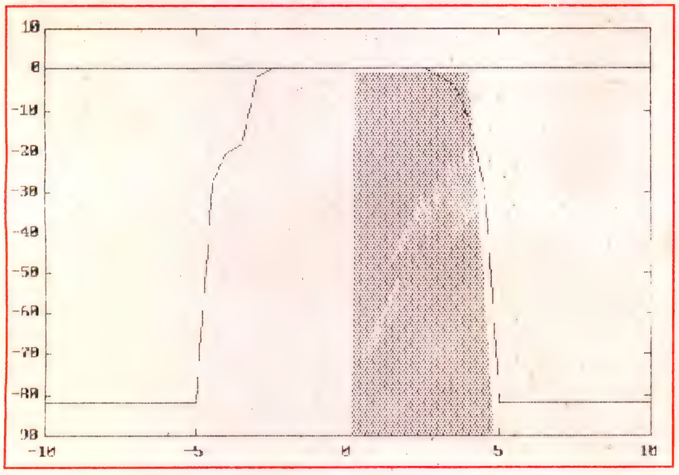


Fig.7: Some international broadcasters are now transmitting on SSB or DSB — but with a full 5kHz audio bandwidth, so they sound good with a 'wide' filter.

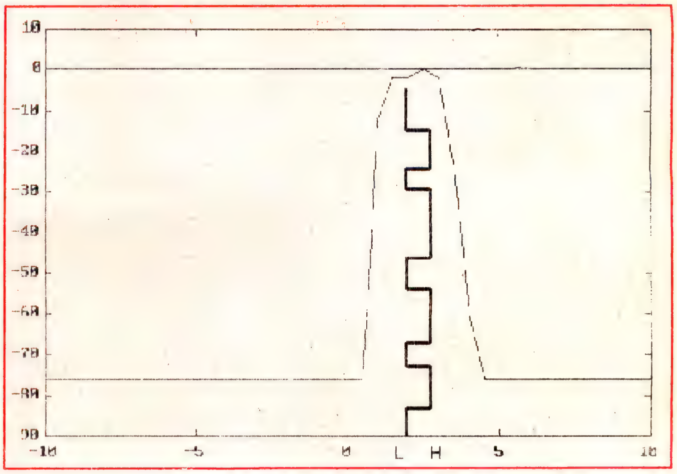


Fig.8: Digital signals like Morse, radio-teletype or fax are best received using the 'narrow' IF filter. Both 'mark' and 'space' frequencies fit nicely in the narrow bandwidth.

fect fit; most of the signal information is within the filter, and the filter excludes almost everything that is not part of the desired signal. This is an excellent state of affairs, and it shows why people pay big bucks for top-of-the- line receivers.

Now compare Fig.6 with Fig.5. This is the measured IF response of a Sony ICF-SW7600 portable receiver, superimposed on the same upper sideband signal as in Fig.5. This filter is very wide (and it's the only filter available in this radio). The sides (known as 'skirts') are gently sloping instead of near-vertical, and the filter is unable to attenuate much below a level of 50dB or so. As well as the USB signal, it will allow through noise, interference, and other rubbish many kilohertz to either side.

If the SSB signal is fairly strong and in the clear, reception will be fine. But if the signal is weak amidst interference, the radio will find it heavy going. This is certainly not intended to tip a bucket on the SW7600 receiver; it just shows what you get for $400 instead of $2000. I recently purchased an SW7600 and it is my current pride and joy.

Back to fancier radios: The IF Shift or PBT control of course works on SSB signals as well as AM; in fact, that is its primary purpose. In receivers in which the whole filter response shifts up and down, if you move the filter so as to avoid some interference from below, it also allows through more spectrum from above. If this is beyond the space occupied by a narrow SSB transmission, it adds some noise to the system.

In the Icom R-71A, the filter doesn't move as such; the PBT control causes the filter to get squeezed from one side or another. So if you chop off interference from below, it doesn't pass any more spectrum from above. In other words, the filter gets narrower. This is a very effective arrangement for SSB, but it's just about useless for picking out one sideband of an AM signal as described above.

As mentioned, most receivers automatically select the narrow filter when in SSB mode. But the R-71A, and possibly others, lets you use the wide filter for SSB. This is only useful if there is no interference, but it means that the receiver can then demodulate SSB signals with audio components out to 5kHz.

It is interesting to listen around the amateur bands using the wide filter. Every now and then a signal will come along with close to broadcast-quality audio. Nine times out of ten these transmitters are of Kenwood manufacture, and they are lovely to listen to. You'd never know they were so silky smooth if you listened through a normal 'narrow' SSB filter.

In order to conserve spectrum space and transmitter power, some international broadcasters are now transmitting on SSB, although using the full 5kHz modulation. With a normal narrow SSB filter their signals are of 'communications quality' only — in other words 'narrow band', as if heard over a telephone. But if you switch in a wide AM filter they sound every bit as good as a full-blown AM signal.

This is shown in Fig.7. Note that the receiver noise figure will be somewhat degraded because only half the filter has useful information, and the other half is open to rubbish. But with a reasonably strong signal, you'll never notice it.

Digital modes

Finally, a few words about digital modes, such as radioteletype and facsimile. Here we do not have modulation of a carrier as such; instead the carrier is simply shifted back and forth between two discrete frequencies. The amount of shift may vary from 70Hz for narrow teletype, up to 1kHz or so for fax. Both the frequencies must be passed through the receiver, where they are usually (but not always) demodulated as SSB and converted to audio tones.

The narrow filter is almost always used to process digital signals, as illustrated in Fig.8. Here a radioteletype signal is rattling back and forth between a lower and higher frequency, L and H. Both frequencies fit nicely within the filter.

The assigned frequency of a digital signal, by the way, is almost always specified as a *carrier* frequency. So to demodulate it as SSB, it is necessary to tune your own carrier frequency 1.6kHz or so from the 'assigned' frequency. For example, to receive the Australian weatherfax station on 11.030MHz as upper sideband, we actually tune to 11.0284MHz.

We haven't mentioned goodies such as noise blankers and notch filters. These will be described as we discuss intelligent operation of HF receivers in the second of these articles, next month.

So far we've gone over the things that happen to signals as they pass through the radio, and the importance of bandwidth and dynamic range. With this information, clever use of all the knobs and switches will be a snap. Next month we'll also have a quick look at some of the receivers on the market and how they can be used for AM, FM, and SSB, as well as fax, teletype, and Morse code. ❖

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Australia's satellite TV service to Asia:

THE DARWIN DISH

Australia Television International (ATVI), the ABC's C- band satellite service to Southern Asia, is now into its second year of operation — broadcasting Australian programmes and culture to many of our northern neighbours. Here's a look at what has been achieved by ATVI to date, how it's been done and what seems likely in the future.

by BARRIE SMITH

To the inhabitants of much of SE Asia, the face of Australian television is not Ray Martin or Elle McFeast, but an attractive young Darwin lady, virtually unknown to most 'southerners'.

Rosemary Church is the on-air news face for Australia Television — the ABC's Asian satellite service. When Ms Church was on holiday recently in a remote part of Indonesia, people continually approached her with their thumbs up, saying "Australia Television Boss"!

Australia Television's facility was established in the closing months of 1992, at a pace considered almost 'unseemly' for a government corporation. Approval for a satellite service covering most of Southern Asia was sought from Cabinet by ABC managing director David Hill and granted in record time — undoubtedly helped by enthusiastic support from Foreign Minister Gareth Evans.

The station's primary area (receivable on 2 - 3.6 metre dishes) takes in southern China, northern Australian and PNG, and as far west as Bhutan and Indonesia; the fringe area (dishes 7 - 13 metres) reaches to Korea, Sri Lanka and Vanuatu. Carried also on the transponder are five radio channels — TV sound and 24-hour Radio Australia programming, with three other channels unused at this stage.

The startup cost was $5.4 million. The operating base was settled on as Darwin, and the programming extracted from ABC resources supplemented by input from a Darwin news team, headed by Prakash Mirchandani.

ATVI's seven metre uplink dish on the roof of its building in downtown Darwin. Supplied by Scientific Atlanta, the dish beams the signal at 6.1GHz to the Palapa B2P satellite, where transponder 5 beams it down to viewers at 3.888GHz in the C Band.

John Yip, ABC executive engineer, admitted "the whole project was done pretty quickly from concept to operating status", adding, "from the signing of the transponder lease with Telkom Jakarta, it took just four months to order the equipment, finish the project and get to air on the opening day of February 17, 1993".

"We took only two or three weeks to issue and close the tender. The major time delay was the delivery of the dish, shipped in by sea — this took two or three months".

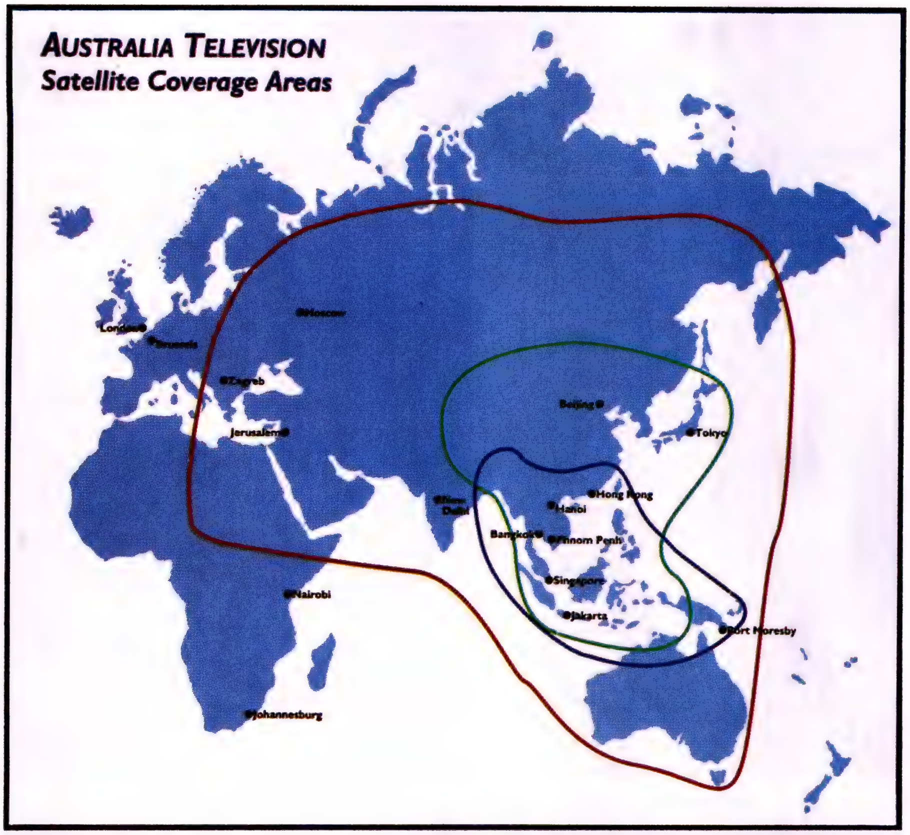
The satellite used is the Indonesian-owned and operated Palapa B2P and carries, beside the ATVI transponder, a motley of other national services — among them Malaysia, France, HBO, CNN and the Australian Nine Network.

The current operational budget is set at $6 million per annum, which is minuscule when compared to other carriers. But from the outset David Hill was confident that the ABC could do it cheaper than major players in area, by relying on his Corporation's extensive programme resources.

From the outset it was decided that the operation would also receive funding from advertising, a matter of initial concern to some ABC staff — but the hard truth of financial viability has apparently silenced the misgivings.

New to the lure of the ad dollar, the Corporation appears to have succeeded in the marketplace. Foundation sponsors of Australia Television included Telstra (OTC), Qantas and DEC; added to this now are AWA, AMP, Ken Done, David Jones, Livestock Corporation, Dulux, Monash University and others. The Indonesian daily newspaper *Republika* is also an advertiser.

Coca-Cola has made a surprise declaration that they will be going on air. Peter Ryall, ATVI Sales & Marketing Director, sees Coke as a perfect



ATVI's satellite coverage of Asia now, and as projected for 1995.

case for ATVI: "We go into over 15 countries, 15 different languages, many different religions and cultures. Coca-Cola think that's fine, because they speak every language..."

Ad rates begin at $55,000 for a three-month campaign using 30 second spots run 80 times, climbing to $460,000 for a 12-month campaign. Thirteen 'Cokes' and you've got the station's budget!

There are no audience figures and there probably will be none for a considerable period, maybe as long as 10 years; but Ryall adds "The potential audience is massive, so you only need to be hitting a small number of the potential audience, and you've got a very decent sized audience."

The ABC believes that what they have to offer is unique, in terms of the quality and range of programmes; many of the other satellite services are news only, while HBO runs only movies.

Ryall claims ATVI is the only service running a "balanced range of programmes, from news and current affairs all the way through to programmes on Australia, lifestyle programmes, even soap operas and children's programmes".

Going to air

The programme makeup is determined in Sydney, with input primarily from ABC schedules plus material from SBS and, in the case of special events such as the Melbourne Cup, feeds from commercial stations.

Editorial guidelines have been set up to ensure material is suitable for the multiplicity of cultures in the viewing area. These are enforced by station management and the ABC's Board.

While seemingly enjoying a wide choice of programmes, hurdles of international release rights have restricted the airing of some material. ABC publicist Kathy Gallaher admits "This is slowly but surely changing as new contracts are negotiated.

Often in the past, and quite rightly, we didn't have any need for the international rights. So they were, in some cases, negotiated out of the ABC. That has changed — now in legal agreements the rights are negotiated as much as possible."

The 16 - 17 hour per day schedule is packed: each night Rosemary Church presents two half-hourly news broadcasts; special international editions of 'First Edition' and 'World at Noon' are aired, as well as 'Four Corners', 'Lateline' and the business programme 'Bottom Line'. This is supplemented with news updates in Bahasa Indonesia, Cantonese and Mandarin.

Comedy is covered by such programmes as 'Mother and Son' and 'The Late Show'; the drama list includes 'Phoenix', 'Secrets' and 'Power Without Glory' — no doubt to the posthumous joy of Frank Hardy!

Children's programming includes 'Playschool' and 'Mr Squiggle', complemented by such high profile 'info' programming as 'Quantum', 'A Question of Survival', etc. And yes, Elle McFeast's 'Live & Sweaty' also gets a run on the dish — plus as much sport as can be crammed into the crevices!

Compilation job

Tony Bowden, Head of Television Resources in Darwin explains that the material is delivered in many ways:

The ATVI transmission suite. Most of the production equipment is by Sony.

"Some of it — like weekend sport — we just take live or from other satellite services, typically the Melbourne Cup. We pick that from Channel 7's distribution system. ABC Sport comes free to air, so we just turn that around. A lot of the programmes, like news, education programmes, they come up free to air anyway; we just record them and turn them around. A small percentage of material is freighted up on tape."

Bowden adds: "Living in Darwin is a Presentation Co-ordinator, who ensures that the programmes 'fit'. The commercials are inserted into a (Programme Operational Schedule), written for each day. A small group of four transmission officers — called 'Co-ordinators' in the commercial world — re-record this material, replay in sequence and insert the ads and promos."

So how do the hundreds of millions of potential viewers get to know what's on, and when?Prakash Mirchandani, ATVI News Director, explains that the audience is informed "largely through newspapers and TV guides who publish the programmes in most countries". He adds: "We have a fax poll number as well, which we advertise for anyone who wants to get programme information. As you can appreciate giving individual information would be a vastly expensive operation."

Viewer feedback

When questioned on audience response, Mirchandani happily relates it has been "very positive — particularly the responses we get from very senior people in government, largely because of connections with the Embassy or even through our ABC contacts in the region."

"The biggest drawcard is the news service: a lot of people feel it is probably the most regionally focused news service, preferable to the BBC and CNN."

An unlikely foe at the outset was the NT government, feeling that clumsy 'southerners' would tread on their unique links with Asia. But, according to Mirchandani, "there was a notice issued just after the station's first anniversary, to the effect that they are very pleased with it".

In early negotiations, David Hill went to China, under the impression they would say "Let's have your wildlife stuff, or let's have 'soft' material." But the first thing the Chinese said to him was "Can we have your news and current affairs?"

Rosemary Church — Australia's face in Asia — and associate news producer Adrian Rhodes, with the uplink dish in the background.

Says Mirchandani: "The Chinese network CCTV (audience 638 million) has agreed to rebroadcast the signal. And the same applies to Laos and Vietnam. We are on cable in Singapore; obviously being restricted, it was very good to get in on cable there."

The station's Varian high power amplifiers, exciters and downlink monitoring receivers.

"The very first news exchange agreement I concluded was with Singapore Broadcasting Corporation. Speaking to them they were very keen, because they saw us as a quality channel — which they wanted — and which, because of our editorial policies, was not threatening them in any way; they did not perceive a bias."

"The message I've had from all these countries is 'We don't mind what you say, as long as you're balanced."

Have there been any complaints?

Replies Mirchandani: "None for news and current affairs at all. But we've had negative feedback on the low grade sport we show on weekends — schoolboy rugby and stuff like that. Through other services they're getting world championship stuff — so why the hell should they look at school rugby!"

Darwin's plant

ATVI operations are run from the ABC building in Darwin's CBD, with the uplink dish on the roof. The compact building accommodates about 60 people. Based in Sydney, engineer John Yip explained a variety of companies were responsible for the installation. These include Varian, for the Klystron HPA (High Power Amplifiers); Scientific Atlanta for the seven-metre dish; and Wegener for the audio modulators.

ATVI: the details

Satellite	Palapa B2P (113°E)
Transponder	5H (Horizontal downlink polarity)
Frequency	3880MHz (C-band) (equivalent to 1270 MHz L-band, LNC output)
IF Bandwidth	27MHz
Sound subcarrier	6.80MHz (TV sound, FM) 7.20MHz (Radio Australia) 6.10MHz (Panda I - future use) 6.40MHz " 7.50MHz "
De-emphasis	75us
Video system	PAL B (video bandwidth 5MHz)
Encryption	No
Dish size	2-3.6m in most locations

Coverage	**Dish size**	**Regulations**
Indonesia	2-3m	No significant restrictions
Brunei	2m	"
Philippines	2.6-3.6m	"
Thailand	2-3.6m	"
Hong Kong	3.6m	"
Taiwan	3.6m	"
Papua New Guinea	2.6-3m	Regulated
Vietnam	2.6-3.6m	"
Laos	3-3.6m	"
Southern China	3.6m-5m	"
Malaysia	2m	Prohibited without consent
Singapore	2m	"
Myanmar	2.6-3.6m	Regulatory system not yet developed
Bangladesh	4-5m	"
Cambodia	2.6-3.6m	"

Footprint

Satellite footprint covers China, Indonesia, Brunei, Philippines, Hong Kong, Taiwan, PNG, Vietnam, Laos, Singapore, Thailand, Vietnam, Malaysia, Bangladesh, Cambodia.

Rebroadcasting

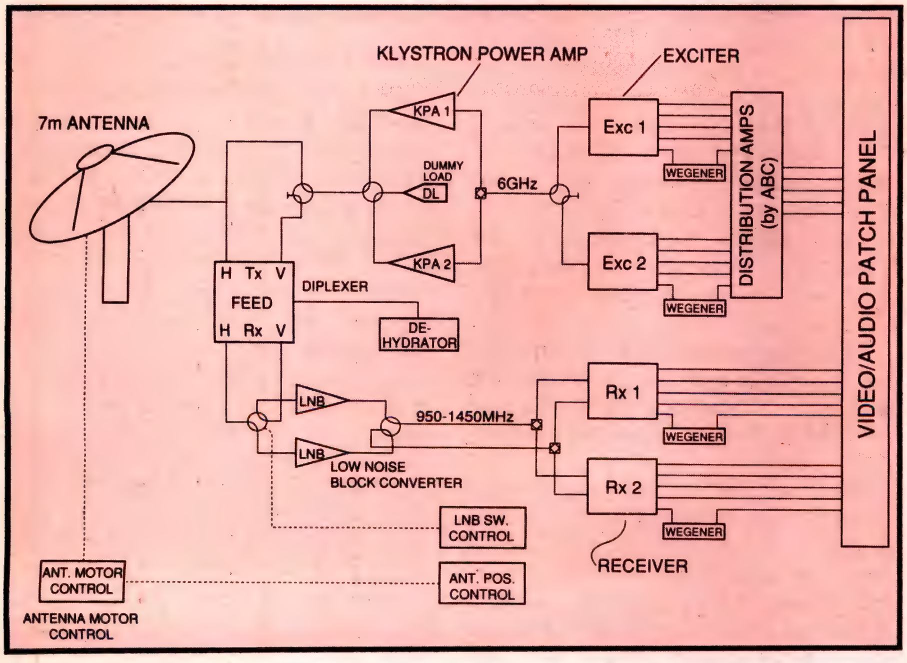
Countries who rebroadcast the signal: China, Philippines, Laos, Singapore, Thailand, Vietnam.

Dish/Receiver packages

Start from US$1000. Many institutional, hotel and commercial premises equipped with dishes. Community dishes increasing.

Audience

Asia currently has 240 million TV households. Potential audience of 670 million viewers.



A block diagram of the Darwin satellite terminal for ATVI. The 7m dish is used for both the 6GHz uplink and for downlink monitoring of the 3.8GHz signal from the satellite, using a diplexer. Note the duplication of all key components.

Most of the studio equipment is by Sony. Yip detailed the signal path: "Programming goes into the uplink chain of the earth station. The uplink chain comprises a number of processing units, which include Wegener modulators to provide the subcarrier modulation. The signal then goes into the exciter — a video modulator and up-converter, lifting it to a 6GHz signal. Then it goes into dual-redundancy Klystron power amplifiers, and finally to the dish itself".

"The signal is received by the satellite and then is downlinked as a 4GHz signal. The set frequency is 6105MHz for the uplink, and 3880MHz for the down."

"In the Darwin earth station we have a downlink chain which allows us to monitor 'off air', to observe the parameters are correct and detect any measurable interference."

"The TV sound is on a subcarrier of 6.8MHz. Radio Australia is on 7.2MHz, using the Wegener Panda I modulation. This uses straightforward FM modulation which is inefficient and when you want to add more subcarriers or sound channels you have to resort to this Panda I, which is a more efficient type of narrow band modulation, giving the same results but occupying much less bandwidth."

"In order to transmit additional sound channels using the Wegener we just plug in separate cards; then it will send the signal out — all these subcarriers are independent of each other. Normally within that bandwidth you could only carry one channel."

Had there been any teething troubles? There had been a few initially — mainly in communicating with the master control centres of other countries. Fortunately ATVI's multi-national staff — Vietnamese, Thai, Hindi, Urdu, Punjabi and Indonesian — provides enough people to help set things up.

The future?

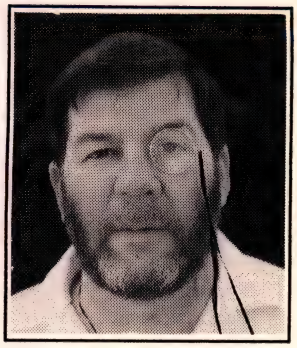
Later this year, Australia Television's service will be carried on a Hughes satellite Apstar 1, moving to Apstar 2 by April 1995. Palapa will continue to carry the signal. The far-reaching Apstar, with a much more powerful signal, will extend coverage to all of Asia, the Middle East and parts of Europe and Africa — most of which could use dishes as small as two metres.

As David Hill proudly proclaimed in May last year: "By early next year it will be possible to downlink Australia Television from Moscow to Tasmania."

But what will they think of us in Hobart? ❖

Moffat's Madhouse...

by TOM MOFFAT



Some technological 'advancements'

About 15 years ago, while I was working as a journalist with a Hobart TV station, I was called to a press conference at the Tasmanian Department of Transport. This is the place that takes care of all motor vehicle matters such as driver's licences and car registration. After many months of hard work and millions of dollars, the department was now ready to show off its new computer system.

This enormous machine was housed in its own glass-enclosed room. It was fully air-conditioned, it had special lighting, and a special mains power source had been provided. The computer itself stood in a row of 19-inch equipment racks, and nearby were several cabinets the size of washing machines that contained disk drives. The disks themselves, multiple platters, were in clear plastic housings on top so you could see them constantly spinning.

Men in white lab coats circulated among the equipment, looking very important. Theirs was the rarified world of the Computer Programmer, a subject which no mere mortal could ever hope to understand. The assembled media were suitably impressed, especially me, since I was right into electronics and had never seen anything like this before except in pictures.

Outside the computer room, in fact scattered all over the building, were computer terminals with their glowing green screens. Operators, after much training, used these to make the computer do its stuff. But they were never allowed to actually step into the room with the computer itself, lest their bad breath or something might contaminate its ultra-pure air.

Demonstration time: We started the camera, and then a computer operator asked me, "What's the registration number of your car?" I told her, AF-3514. "You drive a 1972 Volvo sedan", she said. "It's a four-door, engine number (whatever), first registered in Tasmania in 1976. Your name is Tom Moffat and you live at Fern Tree, your driver's licence number is (whatever) and you are also licensed to drive a motorcycle." And on it went.

Well, I was blown over. That thing was spewing out information as fast as you could read it, and it could do the same thing for every car, or licensed driver, in the whole state. Needless to say the new computer system got an enthusiastic report on television that night.

Now let's move up to the present, say 15 weeks instead of 15 years ago. I was trying to organize a new notebook computer to replace my laptop that had worn out, and I was making the rounds of Hobart's computer shops. In one place, as I was sitting at the salesman's desk fooling around with the machine he was trying to sell me, his mate came through from the next office carrying another notebook computer.

"I want to show you something pretty special that we're really proud of", he said. "A little project we're doing for the government. You can't play with it — I've got to operate it — but you can have a quick look. OK?" I agreed. "Right. What's the registration number of your car?" I thought I'd heard all this before somewhere, but I told him: DD-1188. He tapped some keys on the notebook. "You drive a 1989 Nissan Pintara station wagon. Its engine number is (whatever), it was originally owned by the Department of Primary Industry, you bought it from the government only a few months ago. Your name is Tom Moffat and you live at Fern Tree..."

Well, you get the gist of it. This guy had set up this little notebook computer as a data terminal and he was logged onto the Transport Department's computer right?

WRONG! He wasn't logged onto anything. The notebook was it! Everything! Nothing more required. This computer organization had managed to squeeze the records of every vehicle in Tasmania, and every driver's licence, into this little box smaller than the telephone book on the desk.

The computer had a 200 megabyte hard drive, and they had used one of those new data compression programs to double that to 400 megabytes. And with a bit of clever programming they had copied every record from the big washing-machine disk drives onto this little disk 2-1/2" across and as thick as your hand. So here we have this whole roomful of equipment of 15 years ago, which amazed me so much, replaced by a little $3500 notebook computer. That really brought home to me how much things change...

Out behind another computer shop down the road were some big blue equipment racks. The shop had bought them at auction, filled with computer gear, hoping to make some money out of them. But nobody wanted them, even for free, so the gear was stripped out and taken to the tip.

The shop was now trying to sell the equipment racks. Did I want them? No, thank you. Even for free? No thank you — nowhere to put them. And where did these big computer racks come from? You guessed it, the Department of Transport. They'd gone the full circle.

Data compression

As for this idea of data compression, carrying all the world's knowledge around under your armpit, I can see this becoming one of the most significant uses of computers. Especially notebooks, and whatever replaces them in the future. You can get whole encyclopedias on CD-ROM, to replace a big shelf full of books. But you ain't seen nothin' yet.

Within this notebook computer I'm typing on at the moment are, among other things, the entire contents of the High Court Mabo Decision, the entire Australian Constitution, and the complete King James version of the Holy Bible. These things were delivered unto me, not on a CD-ROM, but on two quite ordinary 3-1/2" floppy disks. They just plug straight into the normal floppy drive on any old computer and away you go, no modifications required.

These disks are an Australian innovation called 'Megafloppy', and I think you're going to hear a lot more of them in the future. The Bible disk is black in colour, with 'Holy Bible' inscribed upon it in silver. My fertile imagination gives me a vision of a powerful preacher, pounding the pulpit and bellowing "Repent, sinner, NOW! or suffer eternal damnation rotting in hell!" as he waves this floppy disk around...

No, let's get serious. The beauty of these Megafloppies is that, like with the Transport Commission computer, you can search for stuff. In the case of the Bible, the first thing I could think of was 'The Lord is my Shepherd'. When I told the Bible program to search for those words, it spun the disk a bit and then filled the screen with the complete text of Psalm 23, with the search words highlighted in Line 1. You can see this Bible-on-a-disk would be a most valuable tool for a clergyman, or a student of theology, or anyone who practices Christianity with any seriousness.

As for the Australian Constitution, I gave it an interesting word to search for: 'Freedom'. And it drew a blank; couldn't find it. Aha — Gotcha! The search program didn't work! But it did, you know. It's just that nowhere in the Australian Constitution does the word Freedom appear. As someone who was brought up under the American Constitution, where many freedoms are specifically guaranteed, I find this a little worrying. It might add some interesting ammunition to the Republican debate.

I gather that the real strength of Magafloppies at the moment is in electronic law books. I guess one day we'll see the beaks scurrying into court with notebook computers under their arms.

But the Megafloppy I'm really waiting for at the moment is the *Macquarie Dictionary.* As a writer I use the *Macquarie* all the time, to the extent that the covers have long since fallen off and looking up anything beginning with Z sometimes fails because some of the pages are missing too. Imagine replacing that monster with a little floppy disk, with a search capability as well.

The flip side

Well, that's this month's *good* news about computers. Now for the bad news, about what happens when computers do what they please without human supervision. To set the scene, let's again go back 15 years. At about the same time as that Transport Commission press conference, I attended another one of similar technological significance. This was to announce the very first ATM (Automatic Teller Machine) to be installed in Tasmania.

The various scribes of press and television turned up at the Hobart office of the Launceston Bank for Savings. And there, set into the wall and facing out into the street, was this mighty machine with lots of slots and buttons and an LCD display screen. This thing was supposed to hand out money day and night, when presented with the appropriate card.

As a little incentive/bribe/payola — call it what you will, each member of the press and various politicians were given their very own bank accounts, with the generous amount of two dollars already deposited therein. We were all marched in front of a Polaroid camera and the resulting pictures were laminated into the cards which would allow us to withdraw our $2 from the ATM while the cameras rolled.

However — yeah, you guessed it — the damn thing wouldn't work. The computer was 'off line' or some such thing, so we took turns standing in front of the kaput machine, raving to the cameras about how it was going to change banking forever. And as everyone knows, the ATM did exactly that. Just not on that day.

So the Launceston Bank for Savings had all these $2 accounts, and no way for the new owners to withdraw the money, at least not electronically. Most of us forgot about them, until we started getting bank statements. I suddenly discovered I had $2.06; the bank had paid interest. Some quick calculations suggested that by about the year 2090, I (or my estate) would have several thousand dollars. I decided to leave the money there to see what would happen.

Over the years bank statements kept coming, and the money grew. Amid much squabbling among the Government and the establishments in Hobart and Launceston, the Launceston Bank for Savings merged with the State Bank of Tasmania to become the Tasmania Bank. But in the financial excesses of the 1980's, the Tasmania bank suffered some 'non-performing' loans in the manner of the ill-fated state banks in Victoria and Tasmania. So the Tasmania Bank got reorganized again into the Trust Bank, which it remains to this day.

Through all the ructions my little account remained intact, and eventually, with injections of interest, it grew to the stage where I had doubled my money. I had four dollars. But today, this very day, the whole thing came a cropper.

In today's post I received a bank statement. *Opening balance: $4.19.* (See? It pays to save...) But the next line had: *Account keeping fee: $2.00.* KerBLAM! There goes half my money. Next line: *State Debit Tax: $0.15.* (Balloon deflating: sssss...) Next line: ZZAPP! *Account keeping fee* (AGAIN!) *$2.00.* My balance was now four cents, less than 1/100 of what it was at the top of the statement. And finally, *State Debit Tax* again, *$0.15.* Now I am OVERDRAWN! I am eleven cents in debt to the Trust Bank!

A message at the bottom of the bank statement hinted at how this all came about: *During April, Trust Bank completed the transfer of all accounts to the one computer system as part of its continuing effort to provide the highest standard of customer service...*

My GOD! What am I going to do? What happens if this new-fangled computer decides to dob me in to one of those credit-rating agencies? "Hey credit-rating computer! We got a guy named Moffat over here, and he's a hopeless deadbeat! He's been overdrawn for over a year now..." And the next time I try to apply for a loan somewhere, they'll say "No way! Bad credit risk!"

Now I suppose I *could* go to the Trust Bank, pay my eleven cents, and close my account. But I don't think so. Instead I will just sit back and see what happens. The computer and its 'highest standard of customer service' will most likely keep adding $2.00 to my overdrawn negative balance, with interest, and in a 100 years or so I shall have to declare bankruptcy. But I don't really care, because as long as this sort of thing keeps going on, it gives me something to write about! ❖

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READER INFO NO. 10

New security products from Jaycar

The exclusive distributor of Bellmate security products in Australia, Jaycar Electronics has expanded its range of security products for homes and smaller industrial/commercial building protection, with the addition of further passive infra-red (IR) detectors and a new four-sector control system.

The new Bellmate 200 is the lowest-priced IR detector in the expanded range, yet carries a 12-month warranty. It is a standard passive detector, with dual sensors providing 24-zone 90° horizontal coverage in three layers, for a radius of up to 12m.

Measuring only 93 x 73 x 43mm and finished in white, the model 200 operates from 11 - 16V DC and draws only 20mA. It provides trip indication via an LED, and is effectively tamper-proof when mounted on a wall, etc. Output is via a pair of NC relay contacts, rated at 0.5A/24V DC resistive. Priced at only $34.95, the Bellmate 200 carries the Jaycar catalog number LA-5017. An optional narrower-field lens for hall and corridor use is available (LA-5014) for $4.95.

Somewhat larger than the model 200, but still quite compact, is the Bellmate 100. This is a pulse-counting detector, which measures 110 x 70 x 55mm and is again finished in white. The detection area is again of 24 zones, and spread over a 90° horizontal angle with a range to 15m radius. It is designed to operate from 9 - 16V DC, with a drain of 20mA.

An internal switch allows the model 100 to be set for either single-pulse triggering or three-pulse count triggering, for additional protection against false alarms. This model also includes additional RFI filtering, to make it virtually immune to transients, etc.

Other features include a LED trigger indicator, and a sensitivity adjustment pot. The output of the model 100 is again via a pair of NC relay contacts, rated in this case at 1A/24V DC resistive. Tamper detection is again included.

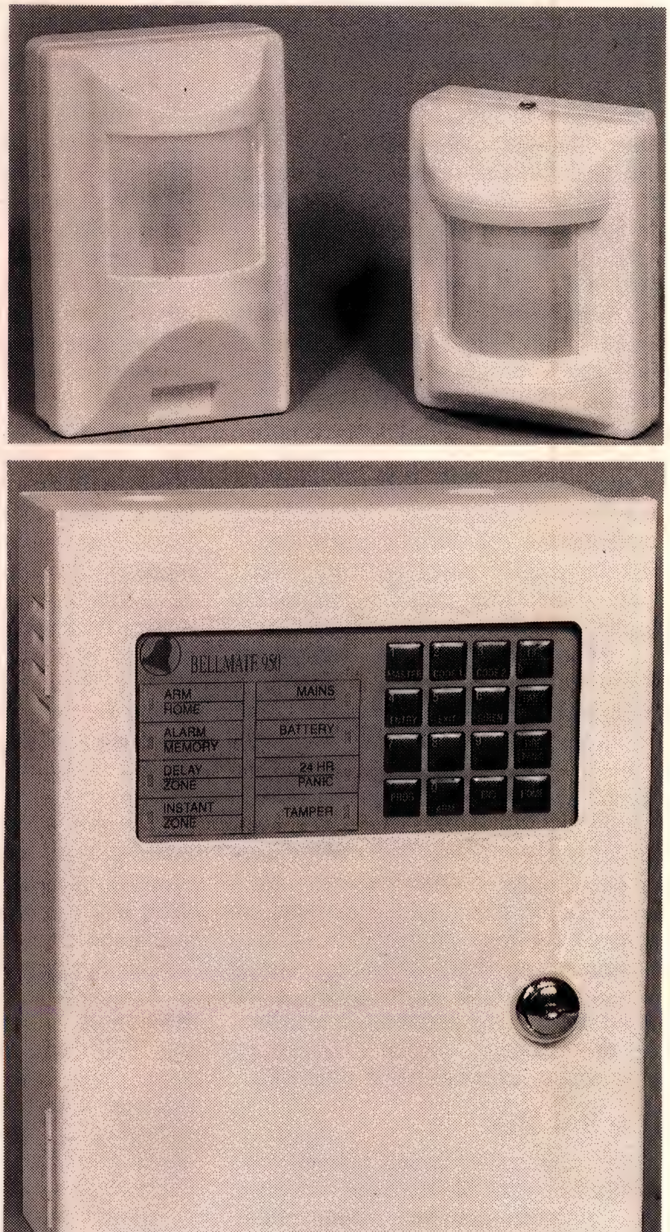
The Bellmate 100 is priced at $49.95, and carries the catalog number LA-5016. It also has a 24-month warranty. As before an optional hall/corridor lens is available for an additional $4.95 (LA-5015).

The Bellmate 950 is a programmable four-sector security control system, similar in many ways to the existing eight-sector model 1000 system but intended more for use in normal domestic situations as well as shops, offices and smaller warehouses. Like the larger unit it comes in a sturdy 1.5mm steel case, finished in beige paint and fitted with a key-operated lock on the front panel as well as an internal tamper switch.

The four alarm zones include instant, delay, 24-hour continuous and tamper detection. The 24-hour zone allows smoke detectors, etc., to operate even when the rest of the alarm system is disabled. All zones provide for end-of-line resistors, so multiple detectors can be wired in series, parallel or series-parallel as required. There is a choice of three 'panic' buttons — fire, panic and medical — which give different sounds for easy identification.

The model 950 is easily programmed via the inbuilt 16-key membrane keypad. A master code is used to enter 'client program mode' to set up the system as desired, while users normally only need to enter one of two alternative user codes. Both the master and user codes can be from two to six digits as desired. Incorrect code entry results in lockout and continued alarming. System status is indicated by eight LEDs and an internal beeper.

As well as the master and user codes, the system allows for



Above top: The Bellmate 100 (left) and 200 (right) IR detector units, both of which provide 24-zone 90 degree coverage. Below is the new Bellmate 950 programmable four sector security control system.

programming of the entry and exit delay times (1 - 99 seconds), and also the siren reset time (1 - 99 minutes). All programming is via simple keypress sequences.

In addition to the four zone inputs, the system provides for a remote key switch. Outputs provided include an oscillating 'siren' output, capable of driving up to two eight-ohm horn speakers; latching relay contacts, suitable for driving a strobe light; a resetting 12V output, for driving a siren or bell; a resetting relay with NC and NO contacts (dry switching); and a zone status output, for driving a LED alongside a remote keyswitch.

The Bellmate 950 measures 246 x 190 x 94mm, and weighs 2.2kg without batteries. The battery compartment in the lower section of the case will accept batteries of up to 6.5Ah, for extended operation without AC power. A power supply of 16 - 22V AC at 1A is required, the standby current being 40mA. Needless to say, Jaycar can supply suitable gel-type 12V batteries with ratings of from 1.5Ah to 6.5Ah.

The model 950 comes complete with instruction manual, mounting screws with wall plugs, spare fuse, mounting and connection diagrams, and terminating resistors (12). It carries the catalog number LA-5320, is priced at $149.00, and has a 12-month warranty.

Jaycar can also supply a compact remote keypad unit, the LA-5321, which can be fitted just inside the main entry door for convenient access. Measuring only 170 x 85 x 30mm, its panel looks almost identical to that on the 950 itself. The remote keypad is priced at $49.95.

Further information on these and the other products in the Bellmate security product range is available from Jaycar Electronics stores, or from the company's head office at 6 Leeds Street, Rhodes 2138; phone (02) 743 5222 or fax (02) 743 2066. (J.R.) ◆

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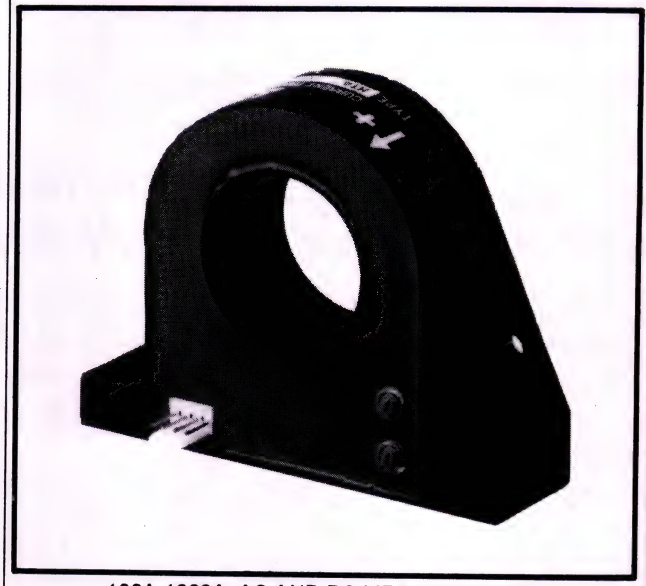

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READER INFO NO. 11

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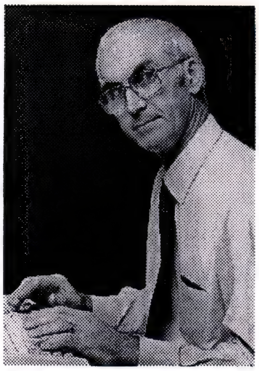

Are you missing out on something, listening to your music via compact discs?

Virtually all of this month's letters to Forum came in response to the March column — specifically to either the letter criticising our discussion of those German tests, designed to see if audiophiles could really tell the difference between CD and vinyl versions of the same original recordings, or the item about the health risks associated with soldering fumes. As usual, there's plenty of food for thought...

A couple of the items I ran in the March column seem to have produced quite a lively response. The first of these was the letter from Kerry Williams of RMIT, taking me to task for the precis I had given in the November issue, about the study by two German researchers who investigated the ability of some 160 people, many of them 'audiophiles', to distinguish between CD and vinyl versions of the same original recording. The other item is the one sent in by Queensland reader A.J. Lowe, about the potential health risk from soldering fumes. Virtually all of this month's letters and faxes have been triggered off by these items, either directly or indirectly.

The first letter comes from Mr John Smith, of Middleton in South Australia, who is actually responding to *both* of these items. Here's what Mr Smith has to say:

May I enter a comment on the so called 'Golden Eared' brigade? The March edition of EA carried a letter from a Mr Williams regarding the, in the main, saga of digital versus analogue and maybe the 'special' cable debate (or argument).

The question I ask is if these people have ever owned a communications receiver? Have they ever 'sat' on a station for an hour just for an ID, through the QRM and QRN? If they have, then why all this debate about the quality of sound? If they havn't experienced this type of noise then I suggest they try DXing — THEN see if they ARE Golden Eared!

Another item in the same Forum raised the question of fumes from resin cored solder. I am an asthmatic and the way around the problem that I have found is that during winter, I have a bench height fan heater blowing across the bench and in summer a small personal fan doing the same job. It works, so I don't need medication and I don't see why all the chemistry and need of protective gear should worry the casual solderer.

In the industry, it may be another matter; then it is under industrial laws of the relevant States and the authorities could act (no pun intended, but I wouldn't hold my breath on that one).

Anyway, thanks for a great magazine even if I do get a kick in the rear for my comments.

I'm certainly not going to 'kick you in the rear', Mr Smith, although I'm not entirely sure of the point you're making about audiophiles and their ears. You seem to be making the point that people who argue about the 'sound' of CDs vs vinyl discs, or one kind of cable against another, are splitting hairs — compared with much more gross differences, like 'clean' and 'noisy' radio reception. But did you mean more than that?

Some of the sounds which emerge from communications receivers are certainly anything but high in audio quality, I agree, and compared with this kind of problem some of the things debated by hifi enthusiasts *do* seem a bit academic at times. They do sometimes seem to have a similarity to those arguments beloved of medieval theologians, about how many angels would fit on the head of a pin!

Your comments about the use of a fan or fan/heater blowing gently across the bench, as a dissipator of soldering fumes, are indeed very interesting. In fact Sydney reader and contributor Bob Parker, who is a service technician, apparently discovered the same thing a couple of years ago, and when the March issue was published he too responded by sending us details of the 'Soldering Fume Buster' fan he developed as a result. You should find it described in this issue, if space allows.

It's very relevant that despite your own asthma, you've found this approach quite effective in preventing any obvious ill effects from the fumes when you're soldering. So thanks for your comments, Mr Smith, and for your compliments regarding the magazine.

More on audio testing

We'll return to the soldering fume topic shortly, but in the meantime here's another letter which arrived in response to the letter from Kerry Williams, on the subject of audio testing. This one comes from Graham Byrnes, of Brunswick in Melbourne, who has contributed to a number of previous discussions. This time Graham seems to have sprung to my defence, which is very nice — especially since I happen to know that like Mr Williams, he's an experienced and highly qualified academic.

Anyway, here's what Graham Byrnes has to say:

Having read the letter from Kerry Williams in the March Forum, I have to wonder if he wasn't in fact testing your dedication to 'due analysis', since some of the 'generally agreed 'facts" are utterly wrong...

He states that the CD standard sampling frequency of 44.1kHz is 'too low for accurate recording of music in the range 20Hz to 20kHz'. While there will always be debate about the subjective question of whether the 20kHz bandwidth is sufficient, the matter of the sampling rate needed to accurately record that bandwidth is not subjective at all; it comes down to mathematics. In fact it is summed up in a theorem of

SOMEHOW, BILLIE HOLLIDAY'S NOT THE SAME WITHOUT THE SCRATCHES AND CRACKLES..

Nyquist, stating that if a signal has bandwidth strictly less than ω, then it can be recorded and precisely reproduced using a sampling rate of 2ω. In fact for a signal of finite duration the proof amounts to nothing more than the fundamental theorem of algebra (that a system of 'n' independent linear equations in 'n' unknowns has exactly one solution) and I would be happy to take Mr Williams through it.

Comments that transients exist with rise times fast enough to be invisible to the sampling are completely false, ***for a bandwidth-limited signal****.*

Now there remains the question of how one obtains an appropriately bandwidth-limited signal. One must indeed use filtering. However the commonly used sigma-delta A-D converters (such as the Crystal CS5326 series used in the Panasonic SV3700 and the Sony TCD-D3) sample at 64 times the eventual recording sample rate — i.e., above 2.8MHz — then use linear-phase digital filtering. It is far from clear that such filtering 'inevitably produces sonic artifacts'. Presumably Mr Williams is referring to the time-domain ripple due to a brick-wall frequency domain filter: however it should be noted that this effect is outside the 20kHz bandwidth.

Yes, some CD-player manufacturers (notably Pioneer and Wadia) have implemented 'anti-aliasing' filters which are monotonic (no ripples) in the time domain. Consequently they have two possibly audible effects: they roll off the top end of the in-band signal, the Pioneer being -3dB at 20kHz, the Wadia -5dB, and they produce some distortion above 22kHz (for which reason they should really be called aliasing filters). Given the audibility of the first of these effects, it is not proven that the extra noise above 22kHz is audible. In no case can it be considered a more accurate reproduction of the original signal, since all the original signal above 22kHz was stripped off at the recording end.

Mr Williams mentions wide bandwidth vinyl systems. So far as I'm aware, these were only set up in order to record multiplexed four-channel recordings and I have heard that they are far from linear at 30kHz. It has also been suggested to me by audio engineers that while an analogue tape recorder can be set up to record up to 40kHz, this will be at the expense of its bass response — i.e., analogue tape is limited to about 10 octaves.

Finally, if you don't define your terms you can prove anything. So what is micro data? Mr Williams proffers 'fine detail', but since the noise floor is so much higher for LP's, I don't really see that vinyl 'excels at reproducing micro data'.

I propose the following self-help experiment: take an audio signal generator set to 7kHz, through a good, stable amplifier into a good quality tweeter (not a piezo!). Now throw the switch from sine-wave to square-wave and see if you can hear the difference (allowing for a level change). Is the sound more distorted to your ear? The harmonics of a 7kHz square-wave are at 21kHz, 35kHz, etc., etc. You should probably have a CRO on the output of the amp to check for instability due to the high slew-rate, and don't use too high a level if you value the tweeter. If you hear no difference (I confess I fail even at 6kHz), you can probably stop worrying about the frequency limitations of CD.

Thanks for your comments, Graham. I take your point about Nyquist's theorem and a bandwidth-limited signal, which is fair enough — although I suspect Mr Williams would argue that his *real* point was whether or not a signal with a bandwidth limited to 20kHz or thereabouts is capable of conveying all of the subtleties of music. As you say yourself, there will always be debate about this...

Your point about the use of lower-slope 'anti aliasing' filters in CD players is also noted. If I remember correctly, Louis Challis made essentially the same point in his review of the Pioneer 'Legato Link' PD-S901 CD player, back in our December 1992 issue. There's certainly no justification in trying to reproduce signals of greater than the Nyquist limit (22kHz) from a CD, as you point out, because these frequencies have all been stripped off at the recording end. Attempts to try only seem to produce alias signals, as you'd expect.

I guess my own personal reaction to all of this talk about the 'missing' frequency components above 22kHz is that (a) I'm sure *I* can't hear anything significantly above 14kHz or so, any more; and (b) in any case, I have always preferred a clean signal of limited bandwidth, to a less clean signal of wider bandwidth. I remember how ghastly some film sound tracks sounded, when I tried to extend their response...

By the way, Brian Byrnes' suggested test with an audio signal generator switching between a sinewave and a squarewave at 7kHz does sound an interesting one. I'm going to try it myself shortly, although I don't have any expectations of being able to hear a difference. But then, I've never claimed to have golden ears, either.

I wonder if this simple test would be suitable for 'double blind' testing of those people who claim to be able to pick the 'sound' of different interconnecting cables, and so on? It sounds as if it might well be.

Just before we leave this topic, at least for the present, here's another short letter which was indirectly triggered off by Mr Williams' comments in the March column. It comes from Mr Scott Crombie, of Findon in South Australia:

Just a quick comment on your column about CD vs LP records, printed in the March '94 Forum. I would just like to say that I think the main advantage of CDs over other formats was overlooked.

Granted a well-recorded cassette or vinyl record will sound as good as a CD version of the same music. Certainly it does to me, and most others — only the audiophiles with their superior ears and intellect can detect the vast (read 'undetectable') differences in sound quality. However the main plus of the CD is the incorruptibility of the 0's and 1's over time. Whereas a cassette or vinyl record played on a regular basis will deteriorate, no matter how good the playback equipment or how careful the handling, the CD quality remains unchanged indefinitely.

So over time we the primitives (non audiophiles) can detect major differences in audible sound quality. Although the formats are near enough to equal at the start of the race, it's the CD that finishes first, followed by the LP and as far as long-term quality is concerned the cassette is way behind the pack.

Thanks for your comments too, Scott. In general the recording on a CD does seem to be a lot more 'incorruptible' than on a vinyl record or a magnetic tape, at least in terms of 'wear and tear' due to normal playing. The only potential drawback seems to be chemical deterioration of the reflective aluminium (or gold) layer above the pits, which has been reported from time to time.

As you say, though, even though many of us may not be able to tell the difference between a CD and vinyl LP version of the same original recording when both discs are new, we're certainly likely to be able to tell the difference later on — because the vinyl disc will have deteriorated purely as a result of normal playing, even using the best equipment.

Soldering safety

Now let's return to the topic of soldering fumes, and the possible health risks they may involve. You probably recall that A.J. Lowe started us thinking about this, by sending in an item which originally appeared in the November 1993 issue of *IEE News*, published by the Institution of Electronics Engineers in the UK. I reprinted it in the March column, suggesting that it was perhaps a cause for concern even though many of us had doubtless breathed in the fumes over many years without obvious ill effects.

Well, apart from the comments made earlier in John Smith's letter, the March column also triggered off another reader in South Australia to send in a letter, accompanied by some relevant reference material. The reader concerned lives in Para Vista, and although he did enclose his full name, he has asked me to publish only his nickname of 'Jamo' — in case any of his working colleagues should take offence at some of his comments. Fair enough!

Here's Jamo's letter, then. As you can see, he works in a defence force facility, although as a civilian:

In reply to the March '94 Electronics Australia Forum article on soldering safety, I would like to present my two cents worth. I'm employed in the Defence Force (Air Force) as a Calibration Technician, and yes, I do work in a concrete bunker — of sorts. Last year, as our section safety representative, it appeared to be a good idea to find out some information about this topic, in particular whether lead is emitted into the air during the soldering process.

The Environmental Health section provided useful information, especially the 'Dalrymple Report' which is attached. The report states that very little solder metal is released into the air, due to the relatively low temperature at which soldering takes place. It appears that a temperature of at least 500 degrees Celsius is needed for this to occur, and as soft soldering takes place at 200 to 450 degrees Celsius any appreciable quantity of solder metal emission is unlikely.

Personally I believe the fumes contained do contain irritants. In my case I contracted asthma 2-1/2 years after entering the industry, as an adult — though I can't prove that the cause is the fumes; all I have is my suspicions. It seems to me the world is full of chemical irritants which your airways (and the rest of your body) have to contend with. Solder fumes may be just the last straw in a sensitised body struggling to cope with the 'normal' world, to cause breathing disorders.

To control these fume emissions, we use fume extractors (Adcola P/N 6190) which are simple, light weight, small hoods located upon arms which can be easily adjusted to locate above your work. The unit contains a fan, a charcoal-impregnated filter, and a small light. The fan draws the fumes up and through the filter and the filtered air then exits the filter back into the room.

The fume hood must be placed directly over the job to be effective, and it does appear to do a good job. When the filter is clogged (6-12 months typical) it is simply disposed of through the correct channels, and a replacement filter is fitted — cost approximately $10. They can't be washed or cleaned, because the charcoal would be washed away, defeating their purpose.

I have been told by our resident 'grunt' (Army person) that his old unit used laminar-flow benches which have much bigger (fixed) extraction units built around the benches. These obviously would have greater fume extraction rates, with the added bonus that the extracted fumes are withdrawn out of the building. He pointed out that it is more than just the solder fumes to worry about. There are solvents and chemicals used in or on the job, which with the application of heat will produce some rather nasty compounds.

For example: Freon under the application of heat is supposed to turn into phosgene, a type of mustard gas. During gold plating, gold suspended in a cyanide solution used to be used, and it still is in some workshops. Are we opening a hornets nest? Discussion and information can only be a beneficial, even if it helps only one person.

Information on particular substances can be obtained through Material Safety Data Sheets (MSDS).

An equally important safety item in the workshop are safety glasses, yet I sense a reluctance by many (civilians) to wear them. If I may make a blanket statement to say that any work carried out (of a technical nature especially) in the military that has any chance of injuring eyes makes the use of safety glasses mandatory. This requirement is encouraged, practised, and enforced by all.

A couple of years ago I undertook a TAFE consumer electronics course, and one night the instructor suggested I might replace a certain component. Having asked him for safety glasses, his (incredulous) reply was "What — you don't need those!". I insisted several times, stating that we never work without them in the Air Force (I could just imagine all the paperwork if I injured my eyes and hadn't worn safety glasses).

What I'll never forget is his next choice of words, which were "Yes, well, it's a big bureaucracy — no wonder they're so inefficient!"

I'm still shaking my head — what price can you put on eyes? I hope my contribution is of help on this topic.

Yes, 'Jamo', your contribution to the discussion is certainly of interest and value, because it clarifies not only the seriousness that is attached to this subject in the defence forces, but also the techniques used in force facilities to minimise fume inhalation during soldering. So thanks a lot, for the trouble you've taken.

For the benefit of other readers, the 'Dalrymple Report' to which Jamo refers and a copy of which he enclosed was written by one H.L. Dalrymple, an engineer at STC in the UK, and published in 1986 in a report called *Ventilation '85*. It basically describes the development and testing of 'A Local Exhaust Ventilation System to Control Fume from Hand Held Soldering Irons'.

The system described by Mr Dalrymple was developed for an electronics production facility and consists of a small-bore (3.5 - 4mm) stainless steel extraction pipe mounted on each iron, parallel to the barrel and with its end within about 6-8mm from the tip. The pipe of each iron is then linked via 5mm ID PVC tubing, to a vacuum exhaust system fitted with appropriate filters, and ultimately driven by a large suction fan.

Worthwhile results...

The results were quite good, with 'particulate rosin acids' in the vicinity of the operator's noses reduced from a mean level of 0.32mg per cubic metre down to less than 0.04mg/m^3 — a reduction of about 87%. However at the same time there was almost *no* measured reduction in the level of 'aliphatic aldehydes' — which are also thought to constitute part of the potential health risk from solder fumes. These stayed essentially unchanged at 0.03mg/m^3. There was also a problem with clogging of the stainless steel pipes on each iron, due to condensation of resin/rosin in the first 50mm or so...

Despite the limitations, though, STC is apparently quite happy with the improvement achieved in fume reduction, and fitted the system to the plant concerned, where it had operated for some three years by the time the paper was published. Similar systems had also been installed elsewhere in the UK, it seems, so this seems to be at least one reasonably practical approach to fume reduction, in a full-scale production environment.

The Adcola fume extractors mentioned by 'Jamo' also sound good, and the full-scale extraction units above each bench would also be very efficient, I imagine. But none of these systems sounds all that practical for what we might call the typical non-production soldering situation — a single soldering iron, on a bench in a servicing or home workshop — or on the floor behind a TV receiver, as it might well be in field servicing.

But for single users?

There's also the question of cost, quite apart from technical feasibility. Even if they're convinced of the risk to health from soldering fumes, I can't imagine too many people involved in what we might describe as 'casual soldering' wanting to invest in a fume extraction system which would very likely cost as much as a good soldering station — in addition to the cost of the station itself.

Perhaps for many of us, then, Bob Parker's somewhat simpler and less costly 'Soldering Fume Buster' idea is likely to be more practical. It has the disadvantage that it simply 'blows the fumes away', and allows them to dissipate in the room instead of extracting them, but even so it still seems to achieve a significant reduction in fume inhalation. For a 'low end' single iron situation, it's possibly quite acceptable — even though it wouldn't be so in a factory or large servicing workshop, with dozens of people soldering away in close proximity.

I note the comments by 'Jamo' about safety glasses or goggles. I'm sure he's right, that they're very desirable indeed as protection against possible eye injury. Why is it, then, that so many of us are reluctant to wear them?

Perhaps it's a similar situation to the one where many young people won't take an umbrella or raincoat/hat, when they go out and rain is threatening. Even though the odds are high that they'll get drenched, they still won't take the obvious precautions — presumably because they think it'll make them look silly, or a 'wally'. Or like people who smoke, when there's now lots of evidence that it's a definite health risk...

But what do *you* think — why *don't* most of us want to wear safety glasses when we're soldering? I'm a bit biased, of course, since I already wear glasses anyway. If I didn't, I suspect I'd be a bit reluctant too; but I'm not sure why.

Finally, I note that 'Jamo' refers to information sheets which can be obtained through Material Safety Data Sheets (MSDS). If you're wondering about these, you're not alone. They sound as if they may perhaps be published by an organisation involved in occupational health, but I can't say I've heard of them. Perhaps 'Jamo' will send us some more details, for those who would like to get further information.

See you again next month, I hope. ❖

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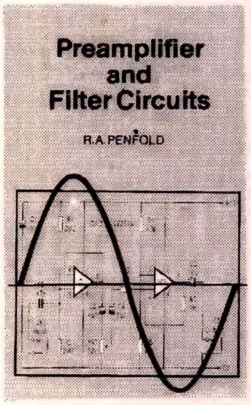

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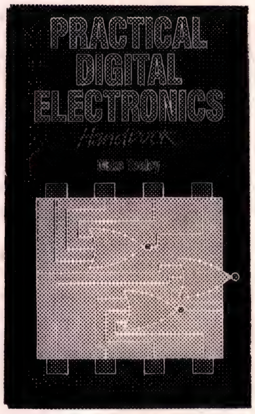

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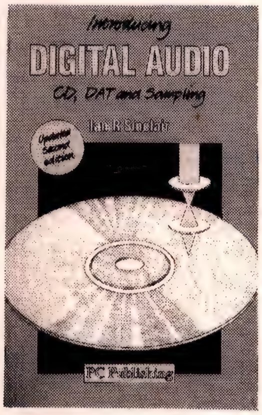

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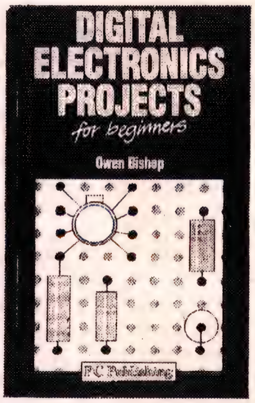

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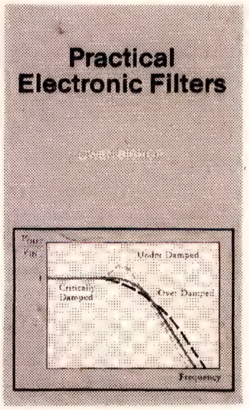

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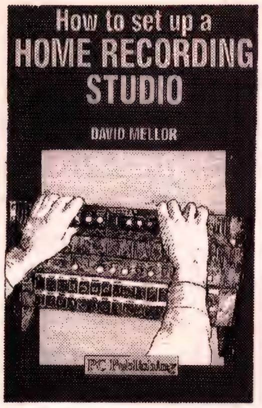

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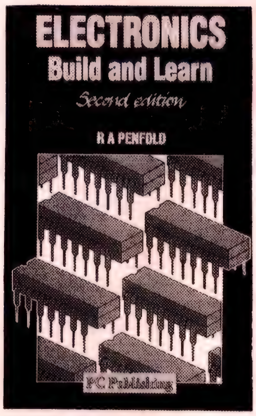

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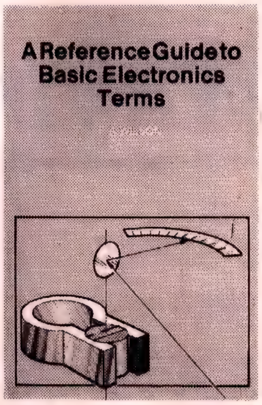

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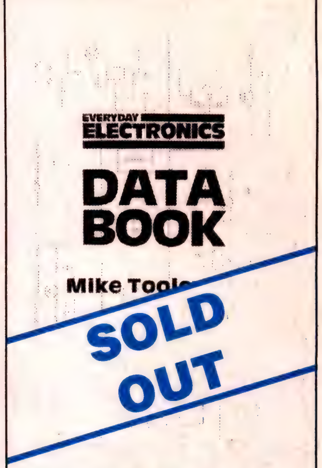

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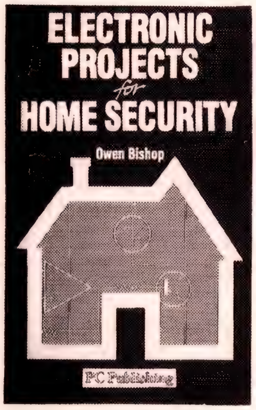

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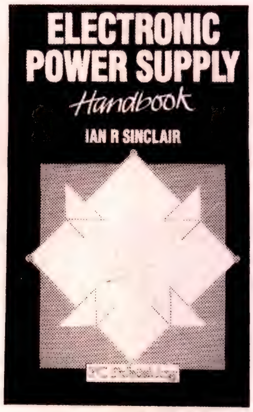

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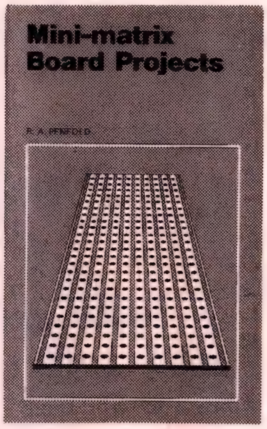

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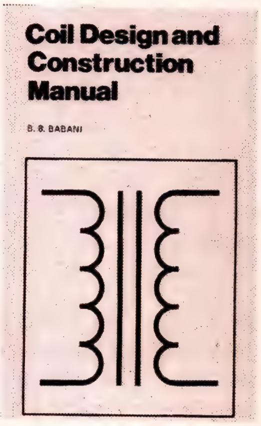

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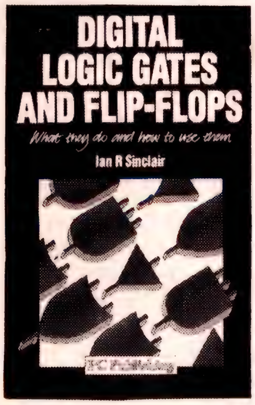

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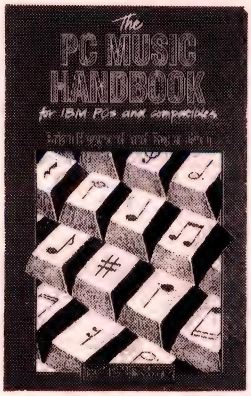

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When I Think Back...

by Neville Williams

'LAY' CRANCH: A varied career in radio, which should stir many memories.

Born in Cairns, Queensland in 1910, Layman W.V. Cranch was issued with a special experimental radio permit at age 15 because he was too young to qualify for a normal amateur licence. Trained as an electrical engineer, he nevertheless pursued a radio career in Melbourne and Sydney, except for a diversion into small ships for the RANVR during World War II.

Readers have asked, on occasions, whether I planned to publish a biography of Lay Cranch. My stock reply has been that I met him during the late 1930's as an executive of Crown Radio but, since then, our paths had not crossed. It was a relatively brief encounter and I knew nothing of his career before or since.

Recently, however, a number of readers took steps to fill the void. Only then did I discover that, while I might have met the one-time executive at Crown Radio, I certainly didn't know the *real* Lay Cranch! We had been too preoccupied with Crown components and *R&H* projects to exchange personal anecdotes.

But such wasn't the case in an interview taped on June 16, 1992, by Geoffrey Holden of the Museum of Victoria and Allan Doble of the WIA. Under the title of 'Lay Cranch VK3CF/VK3T — His Story', a transcript was subsequently published in the *Journal of the Amateur Oldtimers' Club* No.10, March 1993.

For details of the recording, I am indebted to Keith Hoffman (VK4KH) of Toowoomba, Qld and George W. Neilson (VK3TES) of Blairgowrie, Vic. As a transcript of a three-way interview, it was not suitable for direct reproduction in these pages and I have accordingly reworked it into the normal 'Think Back' format. Thanks again to those who made it possible.

As the story unfolds, it uncovers many aspects of radio history and will inevitably jog many fading memories.

Starting at the beginning, Layman (call me 'Lay') Cranch was born in Cairns, North Queensland on October 18, 1910. At age 14, he was apprenticed as an electrical engineer to F.L. Cook and Williams, in South Melbourne, a company which subsequently passed through many hands to become 'Ring-Grip'.

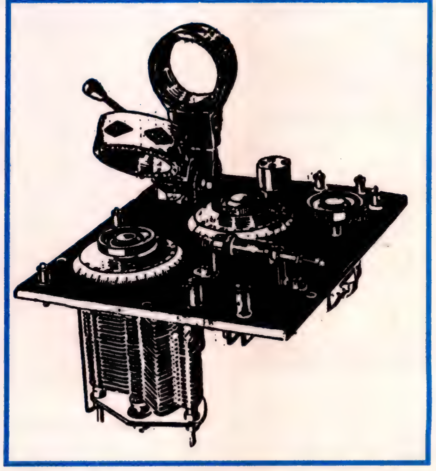

Fig.1: While still a teenage apprentice, Lay Cranch talked his boss into manufacturing rigid and swivelling sockets for plug-in honeycomb coils, as above, and for European style valves.

A budding amateur

Almost from the outset, however, his interest turned to electrical phenomena at a much higher frequency and he took up wireless as a hobby.

Very early in the piece, he managed to 'inveigle' Fred Cook into producing an initial line of wireless parts: sockets for European valves having pins in what he described the 'southern cross' configuration, plus sockets and bases for plug-in coils.

Some 12 months into his apprenticeship, at age 15, Lay Cranch passed his amateur operator's examination but was informed that he could not be granted a normal licence until he turned 18. Helpfully, however, he was issued with a special experimental permit carrying — ultimately — the letters VK3T.

His regular amateur call, VK3CF, came later; but in the meantime, VK3T gave him legal access 'for test purposes' into a range of services — Flying Doctor, marine, emergency services, amateur and so on.

At the taped interview, an 82-year-old Lay Cranch pointed to his QSL cards on the wall, plus photographs of his first crystal receiver and his first one-valve transmitter — complete with Cook and Williams' valve and coil bases!

Lay added that his 'cobber' at the time, Billy Sievers VK3CB, "really got me going" and they began transmitting on the broadcast band on Saturday and Sunday nights after the broadcast stations had closed down. They used the channel otherwise occupied by 3KZ, 'with special permission' as proudly noted on his (then) QSL card.

At age 19 he had completed his five-year apprenticeship and was classified as a 'fully fledged' electrical engineer. As such, he could face the 1929 'great depression' with confidence, servicing electric lifts around Melbourne.

One pay-day, however (Friday in a 5-1/2 day week) his boss 'Cookie' called him into the office and handed him four week's pay, plus the news that he no longer had a job!

"What have I done wrong? I thought you were pleased with my work."

"I have been, which is why I'm paying you a month's wages, in lieu, instead of the usual week. The fact is that you are wasting your time here!"

Fred Cook went on to suggest that Lay's future was obviously in 'this wireless business' and, with all the talk about depression, the sooner he changed jobs the better. To be fair, however, if Lay failed to find alternative employment within three months, he could have his old job back!

Lay admitted that Cookie had done him a great service. Within a week he had found work in the Edison shop in Collins Street, Melbourne, next door to Glenn's Music Shop. At the time, they were selling portable battery sets and rudimentary mains receivers — a Reinartz regenerative detector, audio stage and rectifier.

From the Edison shop he moved to Brashs, building five-valve TRF sets that were the mainstay of their radiograms. Twelve months there saw him move to the test bench at Firth Bros in Latrobe Street. This firm was also producing TRF receivers, but using the much publicised Loftin-White direct-coupled audio system, for which they held Australian rights.

It was about then that Firth Bros decided to move into the production of superhets, which were so rare in the industry that *Wireless World* was still referring to them as 'supersonic heterodyne' receivers — technically correct but verbally clumsy.

1930's-style superhets

In the ensuing re-organisation, Lay Cranch was promoted from the test bench to the lab, as assistant to Howard Love — a pioneer/experimenter whose name looms large in the history of Victorian radio. In an exercise that Lay described in his interview as "pure textbook stuff" he claims to have had a hand in the development of the first 1930's-style commercial superhet in Australia.

This done, first Howard Love and then Lay Cranch resigned from Firth Bros and joined Radiovision, a company with premises in Park Street, Melbourne — across the road from the Domain. Overly optimistic about the future of television, the founders had registered the name Radiovision in the hope of monopolising local expertise in the transmission of visual information.

To generate income in the meantime, they decided to tender for other work and to market a line of domestic superhet receivers; hence the involvement of Messrs Love and Cranch.

Keen to cut costs, the two men decided to exploit the so-called 'autodyne' circuit, in which the first valve would serve as a self-oscillating mixer, thereby obviating the need for a separate local oscillator. The principle had been demonstrated in the mid 1920's with an all-triode battery superhet (the 'Tropadyne' — see *EA* for May 1993), but as to the optimum configuration for a pentode front end, they were largely on their own.

In fact, they managed to get an autodyne circuit going — except that as the prototype receivers were tuned across the band, they tended to drop out of oscillation and 'go dead' somewhere between 3AR and 3LO.

Why this happened they didn't know, but someone noticed that touching a soldering iron onto the autodyne cathode pin would spur them into action — leading to the facetious proposition that they buy a crate-full of reject irons and install one beneath every chassis!

Interesting interlude

Ultimately, Lay said, 'the penny dropped' when he/they realised that the anode was being isolated by what was virtually an RF choke — the primary winding of the first IF transformer. True, it was bridged by a capacitor, but of relatively small value in a quest for a high L/C ratio.

Accordingly, they dropped 100-odd turns off the winding and fitted a larger capacitor, to restore resonance at the IF — and the problem disappeared. Radiovision had their domestic autodyne superhet, which they produced for about twelve months.

(Looking back, I recall that assemblers in the autodyne days were warned never to interchange IFT1 and IFT2, the first and second IF transformers.)

At this stage in the interview, Geoffrey Holden inquired whether, in this period, Lay had met Gil Miles, another well known old-timer associated with Radiovision.

Yes, he said, Gil Miles was there, along with Ross Pitkethley and the overall Chief Engineer, a Mr McDonald. They had built and installed VIM, the current Melbourne Marine transmitter, which was set up in the Domain, not far from the present site of the Shrine of Remembrance.

Gil Miles, as the moving spirit behind the Radiovision section, had put together what was probably the first facsimile machine produced in Australia. It comprised basically a rotating drum which was synchronised to the AC power mains. The drum carried a photograph or sensitised sheet as appropriate and was scanned by a pinpoint light source and a photoelectric (PE) cell, to either use or produce an electrical signal, which could be communicated by landline or radio.

Ideally, the signal needed to be wider than the usual audio passband but, by way of experiment, Radiovision arranged with the PMG for radio station 3UZ to broadcast a 'video' test signal from time to time after their normal midnight close-down. At that hour, there was unlikely to be any hassle from extended sidebands.

Lay Cranch recalled that the most memorable incident involving the facsimile equipment had to do with the opening of the Sydney Harbour bridge in 1932. Ross Pitkethley had taken a facsimile machine to Sydney and was handed not only a formal picture of the opening, as planned, but one of Captain de Groot slashing the ribbon beforehand.

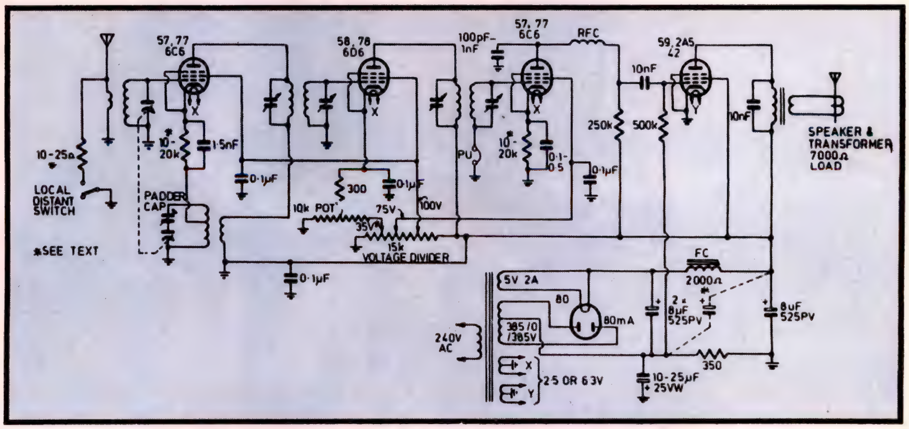

Fig.2: The circuit of a typical 1930's style autodyne superhet. At 'Radiovision' Lay Cranch and Howard Love pinpointed the need to avoid a high L/C ratio in the primary winding of the first IF transformer.

With PMG's cooperation, the latter picture was land-lined to a similar facsimile machine at the Melbourne *Herald* office within three-quarters of an hour of the event — hours earlier than it could have reached its destination by any other means. Although primitive by modern standards, in principle the equipment anticipated the modern fax.

(At the 1992 interview, Geoffrey Holden remarked that three of the machines had been donated to the Museum of Victoria).

That AWA was also experimenting with picture transmission using beam wireless, in the early 1930's, was confirmed at the IRE World Radio Convention, held in Sydney in 1938, by papers submitted by L.A. Hooke and A.S. McDonald.

Time to move on

Perhaps encouraged by the publicity, Radiovision management decided to reorganise and re-establish the Company at Prahan, concentrating on the 'vision' side of the business and dropping receiver and amplifier production. To Lay Cranch, they were backing the wrong horse; it was clearly time to move on yet again!

As it happened, Lay Cranch heard through the 'bush telegraph' that the Essanay Radio Company was in all kinds of strife. (The name had been derived from the proprietors' initials: Messrs Sweeney and Austin).

Essanay had a factory in Swanston Street, opposite Latrobe Street, in what later became RMIT territory. As such, their factory was in the shadow of the 3KZ aerial mounted atop the nearby Trades Hall.

When Lay Cranch called to see them, they admitted to being in 'a bit of strife', which was putting it mildly. Their engineer had reputedly launched a production run of 'superhets or something', and they now had 500 of them on the floor, which wouldn't work. More precisely, they wouldn't tune stations like a proper set, but played 3KZ, no matter where the dial was set!

"Who's your engineer?" Lay asked.

"We sacked him!"

"Then what about your tester?"

The tester was duly summoned, but it turned out that he didn't have a clue as to how superhets worked. Far from knowing what the intermediate frequency was supposed to be, he didn't even know what the term meant!

"How have you been trying to test them?"

"Just twisting this and twisting that! Sometimes you can get some of them to work over part of the band — by guess and by God, I suppose!"

Puzzle solved

"Where Russ Allsop *could* help — I think that was his name — was to provide me with the number of turns on this and that, and a few other details."

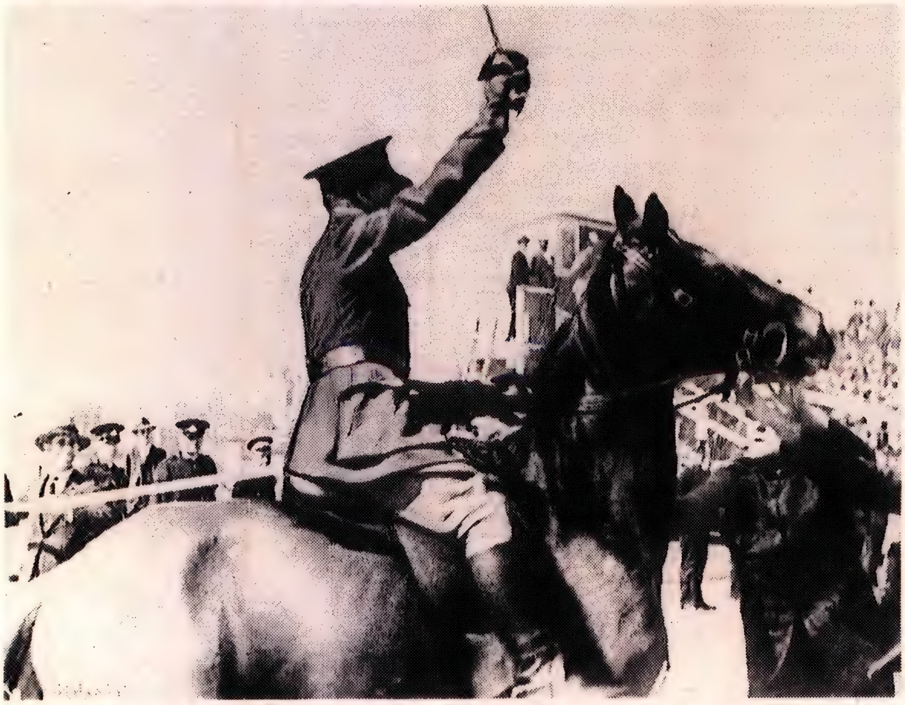

Fig.3: Captain de Groot 'opens' the Sydney Harbour Bridge in 1932. Radiovision's facsimile equipment set something of a record by getting the picture to the Melbourne Herald within 45 minutes. (Courtesy John Fairfax Picture Library.)

Lay added that, in all fairness, once Russ was briefed on how a superhet actually worked, he emerged as an excellent tester.

In the meantime, Mr Sweeney was keen to know whether Lay could find out why the sets wouldn't work and how to get them going. Lay assured him that they appeared to be well built and should respond to the right treatment. That was on a Thursday, and he agreed to take three of them home over the weekend.

By Monday he had two of the three sets working normally, with their IF peaked on 175kHz, tuning right across the band and with no breakthrough from 3KZ. In fact, he was able to demonstrate a clear signal from 3GL at Geelong.

In short order, Lay was offered the position of Chief Engineer at Essanay, with the responsibility of sorting out the existing mess, rationalising the production of components and organising a move to Bockhurst Street, South Melbourne. As to the size of the Essanay factory, Lay wasn't too sure about the figures but reckoned that it would have employed around 100 people, all told.

After six years with Essanay, Lay Cranch resigned and headed for Sydney, which had emerged as the radio capital of Australia. There, in 1938, he became associated with Crown Radio Products Pty Ltd as a Director and Chief Engineer — an association which lasted from 1938-45. (A NSW Govt certificate to hand indicates that Crown was incorporated on March 31, 1938)

Seven years in Sydney

Curiously, in his taped interview, Lay Cranch was silent on his sojourn at Crown, conveying the impression that, as far as his career went, it was a non-event. A faded photo, however, shows him working with an array of test instruments, including one of the first US-made Boonton Q meters to arrive in Australia — a far cry from the technical vacuum he had faced at Essanay.

Mingay's *Radio Trade Annual* for 1939 gave Crown's address as Murray Street, Pyrmont Sydney. The Chairman of Directors was listed as J.B. Philips, the Managing Director as F.P. Jones, with Director E.A. Parmenter and Chief Engineer Layton Cranch. The Company boasted an impressive list of distributors in Australia and New Zealand.

That may not be the whole story, however. There were persistent rumours that Crown had links with RCS — a suggestion which Ron Bell of RCS would typically dismiss with a chuckle.

When I raised the matter again during the preparation of this article, Bob Barnes, the present owner of RCS was less coy about it. Said he: "I've seen documents implying that RCS held a financial interest in Crown from the outset, and that the Crown emblem itself was owned by RCS".

"What's more, some early RCS products carried the emblem — not any old crown, either, but the registered one, as worn by King George. Why don't you check with Olga?"

When I subsequently checked with Ron Bell's widow, Olga, she could offer impressions only, not firm recollections ("It's a long time ago"!)

"Yes, I believe Ron did hold an interest in Crown, regarded as 'not for publication'. I also remember a Lay Cranch — an engineer, wasn't he? — he did a lot of lab work for RCS."

"And there was Radiokes — Ron got involved with them too, I think, when Keith Stokes wanted out!"

I remember speculating about Radiokes in my story about Prices Radio, noting that the much publicised brandlines appeared now to be sourced from little known premises in the same Wingello House in Angel Place.

When I mentioned this to Bob Barnes, he chuckled and said "that checks". His understanding was that Crown was in the process of taking over Radiokes when it was, itself, 'invaded' by RCS. So Ron Bell had picked up an interest in both!

Perhaps that's why I had such a myopic image of Lay Cranch. He had apparently joined the RCS/Crown/Radiokes melange at a period of chronic uncertainty, a few months before the launch of this magazine as a monthly in 1939. At the time, the fortunes of all concerned, singly and collectively, hung on an anticipated boom in mains powered family radios.

By the time I took over, a couple of years later, as Technical (and Acting) Editor, Crown with Lay Cranch as its 'up-front' man was (ostensibly) slugging it out for a share of the components market with Ron Bell of RCS. Both were running full-page adverts in every issue, in an effort to establish a link between *R&H* projects and their particular brand name. Radiokes was doing the same on a smaller scale.

As sure as one month followed another, there would be urgent inquiries as what was being featured in the next issue. With hindsight, I wonder whether the rivalry was as much personal as commercial!

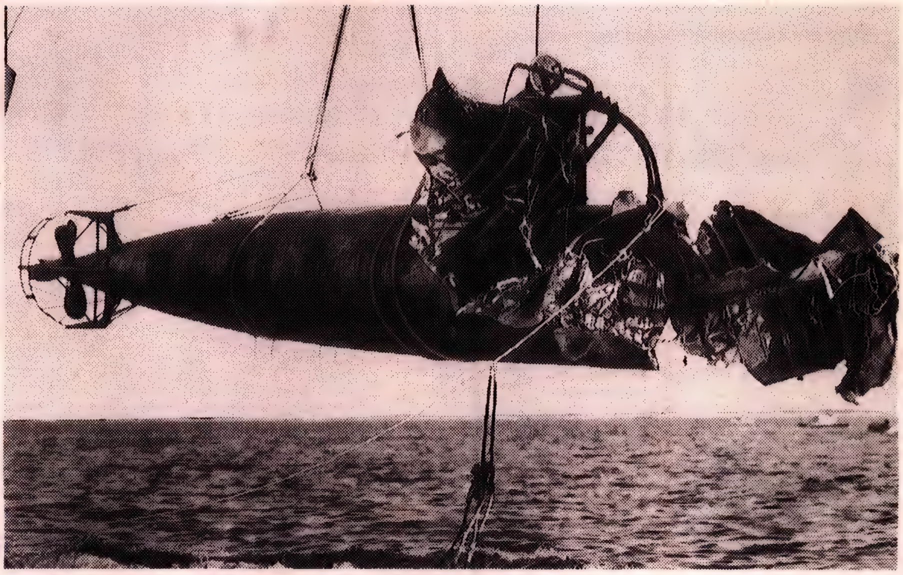

Fig.4: Lay Cranch was in charge of a RANVR boat patrolling Sydney Heads on the night when Japanese mini subs staged their essentially abortive raid on Sydney Harbour. (Couresy John Fairfax Picture Library.)

There was certainly an overlap in product lines. For example, RCS and Radiokes dual-wave dials advertised in the April 1941 issue of *R&H* were identical, even to the use of the same photograph.

More obvious was the fact that in July of the same year, Crown announced that it had switched over to 'Trolitul' coil formers, a technology which RCS had ostensibly pioneered for its own use!

But even that situation was relatively short-lived. Wartime restrictions were placed on the production of new receivers and factory facilities were progressively diverted to essential services.

Lay Cranch was also caught up at a personal level. For some time, he had been associated with the RANVR (Royal Australian Naval Volunteer Reserve), involving 'small ships' operating in and out of Sydney Harbour.

Signals, small ships

He explained that he had trained as a naval signalman: "commonly called a 'buntingtosser', using semaphore and flags and all the rest of it and a Morse lamp at night".

Despite his technical background Lay had deliberately chosen an alternative interest and, when war came, he was consequently classified as a traditional signalman.

When the RAN decided to set up a signalling school at Rushcutters Bay, Lay was drafted as instructor and examiner. The official objective was to match the FND (Flinders Naval School) and turn out 100 signalmen a month; but unfortunately, Lay said, his team were a mite too diligent and produced 123 signalmen in the first batch. As a result, the expectations of Rushcutter were revised upwards to the new — and more exacting — figure!

Shortly afterwards, the RAN set up what was known as the Yacht Master Scheme. Having few if any patrol boats of their own, they commandeered the best of the privately owned power boats, to be refitted as 'rescue craft, sub chasers and what have you'.

Lay Cranch was duly commissioned and found himself in charge of a patrol boat that had formerly been the pride and joy of the Horden family, proprietors of the huge one-time emporium of Anthony Horden & Sons.

So it was that he was patrolling the Sydney Harbour Heads in just such a craft on the night of May 31, 1942 when Japanese submarines slipped through on what proved to be a largely abortive mission.

A few nights later (June 7, 1942) Lay was on the job again when shells landed nearby from over the horizon. Meanwhile, back at Crown, the factory foreman was authorised to exercise day-to-day management, reporting to Lay Cranch whenever possible.

Fairly obviously, Lay Cranch's stay at Crown had been much more transitory and chequered than I had realised; so much so that it simply didn't rate in his memoirs!

What apparently did rate, over this period, was intensive research into ferric particle cores by his former as-

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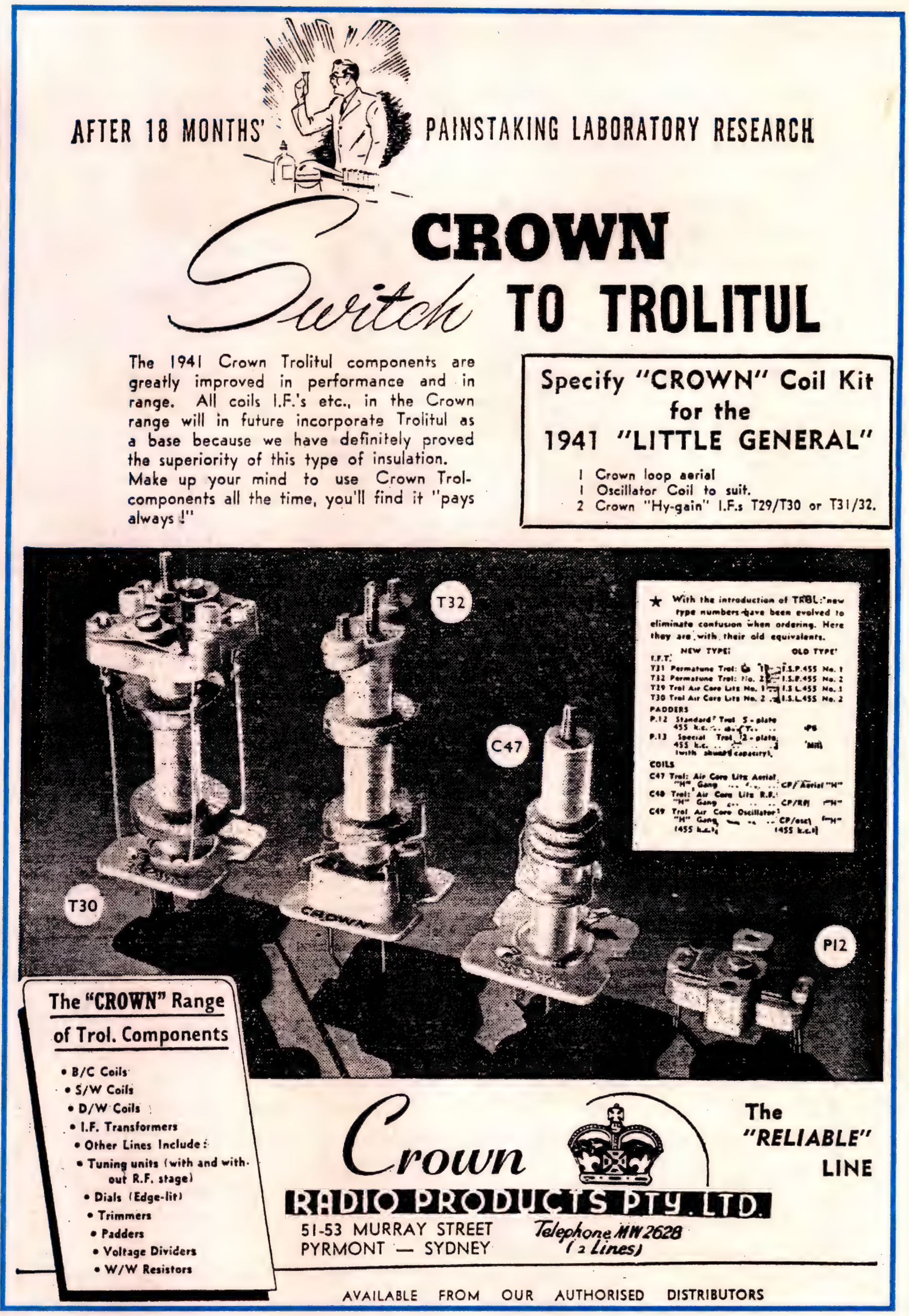
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T30 Trol Air Core Litz No. 2	I.S.L.455 No. 2
PADDERS	
P.12 Standard Trol 5-plate 455 k.c.	P6
P.13 Special Trol 2-plate 455 k.c. (with shunt capacity)	Mit
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Fig.5: Having made a song and dance about Trolitul coil formers, RCS presumably supported the adoption of the technology by Crown in June 1941.

sociate, Howard Kingsley Love. Indeed, it would seem that there was on-going consultation between the two and when the war ended, Lay Cranch promptly resigned from Crown and returned to Melbourne as Chief Engineer of Kingsley Radio.

New-look technology

As Lay Cranch explained, in contemplating the post-war era Howard Love had a vision of so upgrading ferric particle cores that, first off, his company could offer more compact and efficient IF transformers with markedly higher Q-factors — and therefore improved receiver gain and selectivity.

Further, that Kingsley would be able to extend the range of such cores from intermediate frequencies to the high frequency end of the broadcast band, thereby boosting receiver front-end performance, as well.

Having achieved this, he had envisaged high-Q tuning systems with cores sliding in and out of suitably proportioned coils, thereby obviating the need for ganged tuning capacitors.

To ensure low friction and smooth long-term operation, it would be desirable to abandon conventional solid bearings and substitute prelubricated sintered bronze. Far from posing an extra problem, sintered bronze could well make use of comparable factory skills to the processing of ferric particles.

With these objectives in view, Kingsley had assembled what Lay Cranch described as probably the best (radio) design team in Australia: 'chemical engineers, radio engineers, mechanical engineers...'

He had also installed 'the best hydrogen bomb in the southern hemisphere' — a furnace which could process ferric/ferrite particles to thousands of degrees C — in a hydrogen atmosphere!

It was loaded with fail-safe gadgets, in the certain knowledge that "it could have gone off with a big bang if atmospheric gases had got to it"!

Tricks of the trade

Progressively, the team had learned how to produce 'spherical' (cornerless) particles, how to coat them with chemical insulation, how to produce coated elongated particles and how to align them end-to-end when they were injection moulded, saturated with formaldehyde and baked hard.

For 'ferro tuning' it was essential to ensure a uniform particle density throughout the finished rods, so that there would be a smooth and uniform variation in inductance as they were slid through their respective aerial, RF and oscillator coils. Failing that, the end result would be poor tracking between the respective circuits and with the calibrated dial, much as would be evident with a misaligned ganged capacitor.

As it all came together, Lay Cranch said that demand for Kingsley components built up to a level where the sale of complete kit sets was being inhibited by a shortage of loudspeakers; so Kingsley began producing their own. In fact, they were producing quite a few lines on the side, including those inherited from earlier involvements.

It ultimately became apparent, however, that they were in the wrong place; having swallowed firms like Eclipse, Essanay and AZ Radio, Astor was just about the only major manufacturer left in Melbourne.

The rest were in Sydney, and it was a costly and cumbersome exercise freighting completed components across the intervening 1000km.

So the decision was made to open a regional factory in Sydney, where semi-finished products could be assembled, tested and despatched at call.

So it was that, in short order, Lay Cranch and Noel Featherstone found themselves back in Sydney, running a branch factory in Petersham, an inner western suburb. But the expansion was short-lived. Within a year or so, things in Melbourne seemed to go horribly wrong. How or why, Lay Cranch didn't say, but the end result was calamitous. I quote from his taped interview:

"So I'm up in Sydney and so is Noel. Poor old Howard goes round the bend — or somebody did. The result is that I had a phone call to say that Howard had dropped dead and would I come back straight away to take over!"

"When I got back, I said: it's 18 months since I had any management role in Melbourne so I want to know what I'm supposed to be taking over."

The Directors had apparently held a meeting at the cemetery and nominated Lay, in part because he had shares in the place.

"Did I ever! I'd put everything I had into it and I stood to lose the lot!"

Having done a stock-take and audit, Lay argued that the company should be able to trade out of the situation. However the Estate Managers went into a huddle with the accountants and solicitors, and decided that without Howard Love at the helm "It's not worth all the worry. Just forget about it"!

"So Kingsley Radio was wound up."

That happened in 1948, and marked the end of Lay Cranch's taped memoirs.

A footnote appended by the interviewers indicated that, with the winding up of Kingsley, Lay Cranch returned to Sydney and became Editor of *The Australian Radio World*. When that petered out, he joined *Seacraft* as Editor for a brief period, being a qualified yachtsman from his days with the RANVR.

Following that he joined the National Instrument Company, Sydney, as a representative — where he remained for six years. At the end of this period, he joined Jacoby & Mitchell, majoring in instrumentation and opening a Branch in Melbourne. Following this, he opened his own business in Melbourne, specialising in marine electronics. He retired at age 65 in 1975.

In his covering letter, Keith Hoffman acknowledges, in turn, the assistance of Mrs Cranch, Ray Kelly of the Historical Radio Society of Australia and The Museum of Victoria. He adds that Lay Cranch passed away in May 1993, a few weeks after publication of his taped autobiography.

Next month, we'll take a closer look at Kingsley Radio. ❖

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THE SERVICEMAN

Everything seemed to be working, but there was no picture or sound!

I don't have any long, involved stories in my file for you this month, so I have decided to make up a column from the shorter 'bits and pieces' items I've been gathering recently. There's a brief one from a reader who successfully solved a retrace-line problem by applying theory, and some more from my own bench — including one about a CTV where almost everything seemed to be working fine, yet there was no picture or sound. I round it up with a few comments about the way digital circuitry is changing the way TV sets are going to be serviced, and some more information about that 'different line output transformers with the same type number' problem.

We start with a few short stories for your 'infotainment' (a horrible word, but expressive!). They are the sort of tales that don't warrant the full length treatment that is usually reserved for these pages, yet are still interesting enough to make it into the record.

The first one comes from reader T.B., of Midway Point in Tasmania. T.B. is a former engineer with the ABC, so his excitement on solving a distinctly domestic type fault can be understood. He tells the tale thus...

I had hardly finished reading your article on retrace lines (EA, September '93) when I was called to a customer's home where his Sharp CX2232 showed a similar symptom — although in this case the retrace lines were NOT the result of vertical non-linearity, nor faulty blanking.

The Sharp CX2232 (and other models with a similar chassis e.g. CX2072) is a later generation than those described in your article. In these models the blanking is fed into IC801 on pin 2, while the linearity control operates on IC501.

The retrace lines showed the usual Teletext pattern, plus a few shorter lines about 10mm apart and 100mm long on the left of the picture. Significantly, these lines varied very little when the brightness control was altered.

This made me wonder whether the blanking pulses were being altered in some way by an incorrect vertical output waveform. This sort of trouble very often arises from dodgy electrolytics, so I searched for a culprit among the electros around the vertical output stage.

Since I treat all low-value electros with suspicion, I selected one that looked a likely customer. C512 is a 10uF 50V between the emitter and base of Q501 and looked as if it might have been included to give a measure of high frequency cut on the vertical output.

So I bridged another capacitor across it, and BINGO — end of story!

The Fairy Godmother had struck again, and before she could change her mind, I replaced the capacitor. To celebrate, I closed the shop for the day and shouted myself a beer.

Thanks, T.B. It wasn't so much that story itself, but a comment you made which started a train of thought, that could explain the success of my own exercise in Teletext line suppression. That bit you said about 'top cut' makes sense. If the vertical output had excessive high frequency response, it would have a tendency to ring at flyback, which could well modulate the vertical blanking pulse and allow the Teletext lines to be displayed during the negative excursions. Effective top cut would flatten the pulse and presumably, extinguish any video information present during flyback.

It's one thing to be a practical serviceman. It's quite another to be a practising theoretician. Although sometimes, as you've demonstrated, it helps to be both!

Alive, but dead

Now, for a short one from my own bench.

This was a Samsung CB3325J and the complaint was that it 'wouldn't do anything'. The screen lit up, and showed strong snow, but otherwise the set was U/S. There were no channels, no sound, and the brightness, contrast, colour and volume controls would not work — although the tuning search display and channel indication did appear on screen. But there was no way of knowing if the search function was actually searching, since it didn't find any channels.

All of these functions arose in a big LSI chip at the front of the circuit board. I checked all the switches and buttons along the front panel, but every one was working normally. It began to look for all the world as though the microprocessor had 'dropped its bundle'. However, the search function appeared to be OK, although that also arose in this LSI chip. So I checked at the tuner to see if the tuning voltage varied as the chip searched for a channel. There was nothing.

The tuning control arises from pin 1 of the 'big chip', and is applied to a transistor buffer before passing on to the tuner. The 33V tuning voltage itself is derived from the 125V rail ('B2') via

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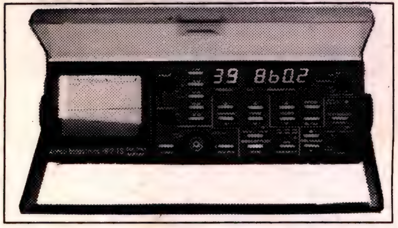

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RR05, a 10k 1/2W resistor. Except that in this case, RR05 measured 2.2 megohms...

So that explains why the search function couldn't find a channel. But why didn't the brightness control work? And what about the volume? In fact, it seems that the big LSI chip contains an automatic mute that stops everything in the absence of a coherent signal! No channel, so no nothing!

That's something to keep in mind.

Monitor hassles

The next story concerns a friend of mine who bought a EGA monitor while in the USA, at a most attractive price. The fact that it was a 115 volt model was a bit of a problem, but he knew that he had a selection of mains transformers at home and that at least one of them had a 110 volt tap that could be used to run the monitor.

In due course the monitor was up and running and all went well for several years. Then my friend was transferred to another city, and left the computer at home with the family. Later, his number one son tried to move the system to another room and in the process detached one of the leads from the transformer.

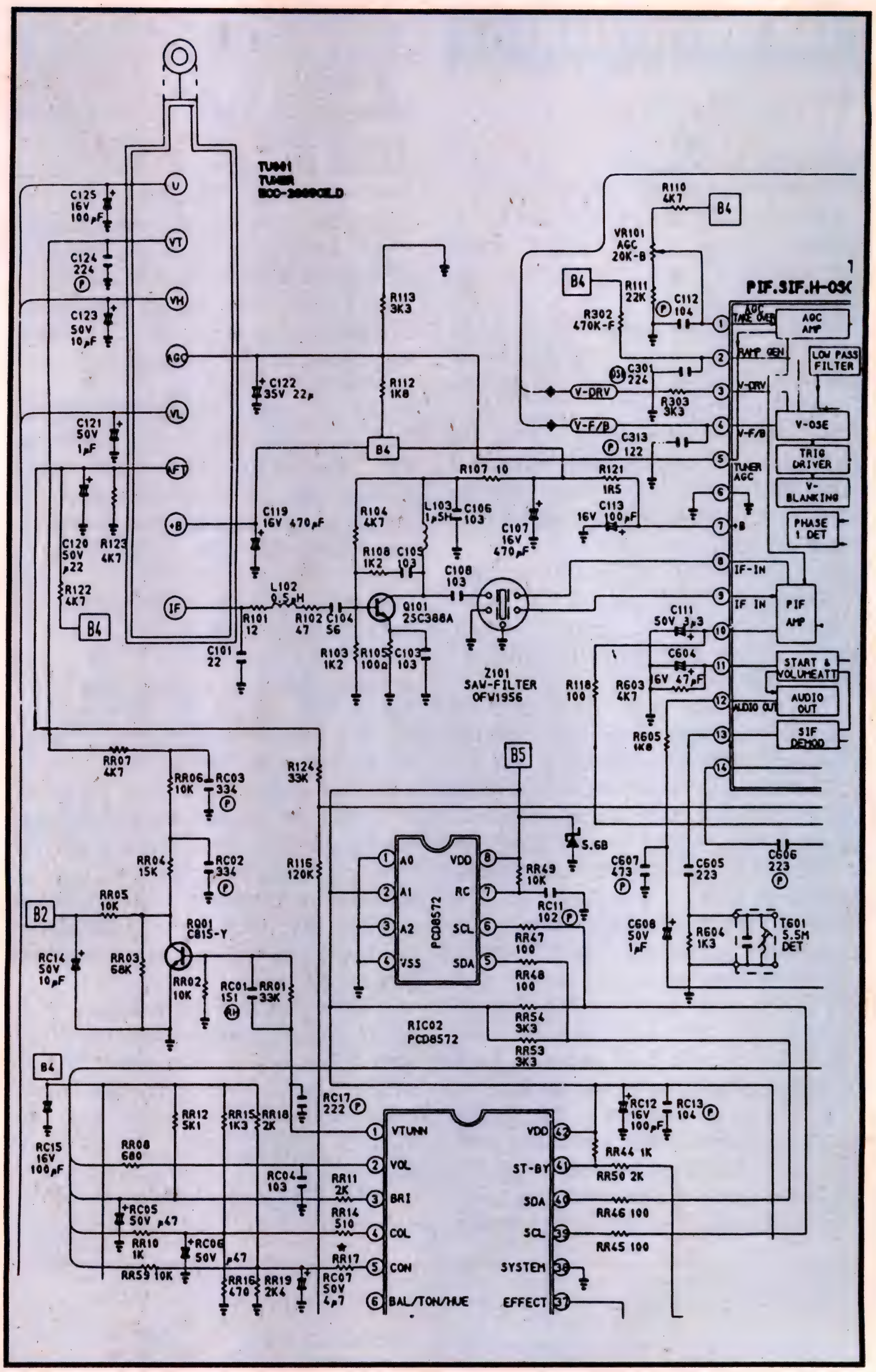
I shouldn't need to explain what happened next...

The end result was the short circuiting of one STR53041 voltage regulator, the demise of a 1.8A fuse, and the spectacular destruction of a 680uF 160VW electrolytic. Fortunately, all items were easily replacable and the monitor fired up enthusiastically when powered by 115 volts from a Variac.

However, I wasn't at all happy about restoring the original transformer since there was no shrouding around the 240V input, nor any simple way of isolating the 115V output from probing fingers. The system would have been OK so long as nobody touched anything, but I wasn't prepared to leave that to chance. So I went looking for a 240/115V transformer and found the perfect thing among the Arlec products. There are four transformers in the range, from 60VA to 500VA, and the 250VA version was ideal for the project in hand.

With everything back together again, I connected the monitor to the computer, powered up the system — and got absolutely nothing on the screen.

Since I had no other source of EGA video to test the monitor with, it seemed that I would have to beg, borrow or steal another computer from somewhere before I could completely exonerate the monitor. But before I went off along that track, I decided to take the owner's machine to my workshop for a closer examination.



Part of the 'front end' of a Samsung CB3325J colour TV. The tuner is at upper left, with the video/sound processor chip at upper right. Near the bottom is the microprocessor chip, with the tuning voltage output emerging from pin 1.

And there, the final explanation was revealed. In IBM type computers, the various function boards plug into sockets on the mother board, in the base of the machine. They are secured in place by screws at the top of the terminal panel, at the back of the computer.

In this case, Mr Somebody had removed the screw holding the video board and when I tried to replace the monitor lead, I had pushed too hard on the board and lifted it right out of its socket. Pushing it back into the socket and fitting a new screw fixed the problem.

I've often proclaimed that I WILL NOT service computers, yet I continue to get tricked into doing just that. But as this story shows, computer service need not be the scary process sometimes claimed and as often as not is a relatively straightforward job.

'TV's gorn funny'

Now for another story from my workshop, one that says as much about the customer as about his television.

The customer arrived with his TV in the back of a ute. When I asked what was wrong with it, he said he didn't really know "...but last night me 'n' the kids wuz sittin' down to tea and watchin' 'Sale of the Century'. Mum wuz servin' up sausages 'n' chips and she sez ter me 'That TV's gorn funny'!"

The conversation went on like this for the best part of five minutes, and still I didn't know what was wrong with the blankety TV. Have you ever had a customer like that?

They'll take half an hour to describe the fault in their TV or VCR or whatever, along the way telling you their family history and pages of other irrelevant material.

This particular individual told me about the meal they were having and the programme they were watching, and the fact that the sound was still OK, and there was colour on the screen and you could see the picture moving — but it was, sort of 'funny'! It seemed to him quite important that it was 'Sale of the Century' they were watching. The programme before that was OK, so it must have been something to do with SOTC that made their set fail. But he couldn't really describe what was wrong with it. And to think that I gave up a good job with the Public Service to do this...

There was nothing for it but to get the set into the workshop and have a look for myself. As I struggled with it onto the bench, I could hear him chattering away outside, still going on about last night's tea and 'Sale of the Century' and Mum reckoning the picture had 'gorn funny'!

I switched on and as the picture came up, I could see immediately what his trouble was. There was no vertical scan! I'll never know why he couldn't have said simply "There's a coloured line across the screen". That would have told me all I needed to know, and saved him 10 minutes of complicated explanation.

As I ushered him out the door, he was still prattling on about SOTC, sausages, etc. I think he was still going on about it as he drove away!

The set was an Hitachi CTP208, and I've seen this vertical collapse before. The chassis uses a vertical output module built on a ceramic substrate. It comprises an array of printed resistors and discrete transistors. What sometimes happens is that the transistors break away from their attachment to the substrate and render the module inoperative.

Current wisdom is that these modules cannot be repaired, but I have had a 50% success rate with resoldering the transistors back into circuit. I felt sure that this would be the trouble with the present job, and set about removing the module for examination. But I couldn't fault it. There was no trace of any broken joints, and the module looked to be in pristine condition. I think it might have been replaced already — this was a new customer, and I had never seen the set before.

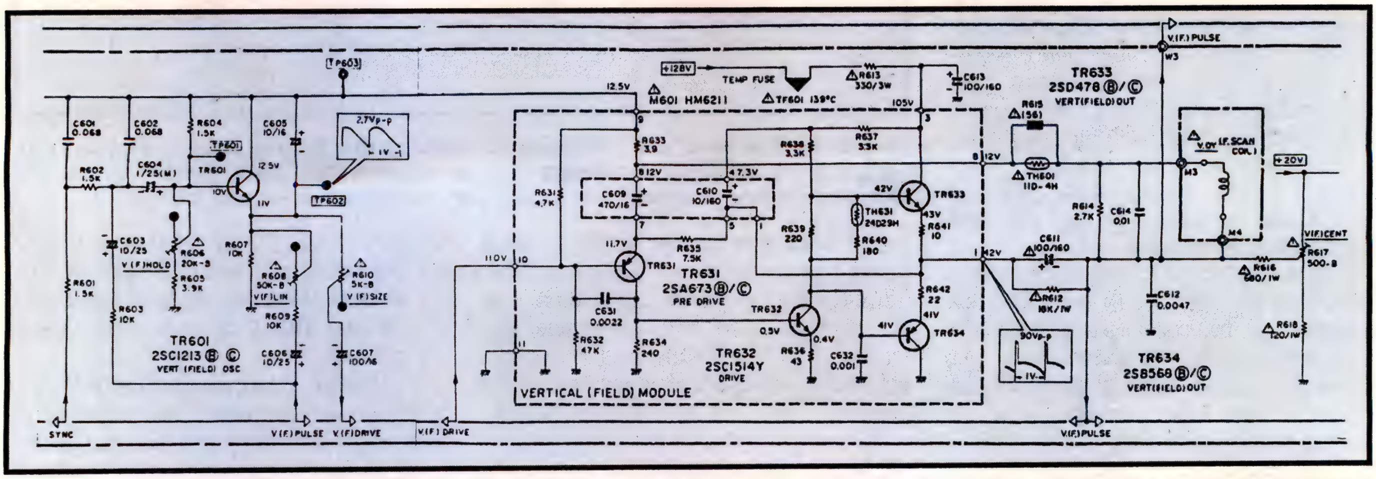
It was about here that I decided to do what I should have done earlier — check some voltages with my multimeter. This would have told me immediately that there was nothing wrong with the module! The B+ input is on pin 3 and should be 105V. It was somewhat higher, at 130V. The really significant voltage was at pin 1, the junction of the two output transistor emitter resistors. This should be 42 volts and was actually showing 49V. From this I could deduce that the output pair were turned on, but were not drawing their full rated current. All of this pointed to the likely fact of the oscillator being dead.

The circuit diagram lists TR601 as the vertical oscillator, and this transistor checked out perfectly. It had more or less the correct voltages on its pins, and the junctions showed no sign of being either open or shorted. There was just one anomaly — the diagram shows a difference of 1V between base and emitter while I could only measure 0.6V.

Most transistors work normally with 0.6V across the base/emitter junction. However, in pulsed circuits such as this vertical oscillator, the average voltage across the junction can be quite different. The 0.6V that I noted showed me that the DC bias was normal, but reinforced the idea that the oscillator was not running.

An oscilloscope is a handy instrument in a case like this. It can confirm the results of the DC analysis, but is not really necessary in this kind of circuit. I used the scope this time, because it was there; but I already knew the answer. The next problem was to determine why the oscillator was not running.

Since I already knew that the circuit voltages were approximately correct, I could assume that the transistors and resistances were OK. This left the capacitors and of these, the electrolytics were the most suspect. There was one electro that stood out as a most likely culprit. A prime suspect was C604, a 1uF 25V capacitor in the base circuit of TR601. All 1uF caps are suss, but this one was more so since it was wearing a pink overcoat...



The vertical oscillator and amplifier section of an Hitachi CTP208. One of our Serviceman's little stories this month concerns one of these sets where the picture had 'gorn funny' — in fact, the picture had collapsed to a horizontal line. Although TR601 on the left had stopped oscillating, the fault was not in the immediate vicinity.

Many of these little caps started life with a blue plastic cover, but whenever the cap is subjected to excessive heat, as with an internal failure, the plastic changes colour to pink. I don't know if this was an intended colour change, but it has always been a useful indicator as to the quality of the electros.

I pulled this one out of circuit and checked it on a capacitance meter. It read 1.1uF and showed no trace of leakage. So much for that idea; but I fitted a new capacitor anyway. (Presumably the cap had a pink coat when it was made — why can't they be consistent?)

Next, I tried C603, a 10uF 25V in the feedback circuit. If this had been open it would have stopped operations, but it proved to be faultless. C606 is in the linearity circuit so I resolved not to worry about that one yet. The next electro under investigation was C607, coupling the vertical size pot to the vertical drive line. This 100uF 16V capacitor could have stopped everything if it had been faulty; but it wasn't. So I had to look further afield.

There was only one other electro to consider. C611 is a 100uF 160V capacitor which couples the output to the yoke (among other things, as I found later!).

The cap was quite easy to remove and as soon as I looked closely at it, I knew I'd found the answer to the problem. The positive pin was surrounded by a thick coating of brown goo and there was another puddle of the same stuff on the circuit board, right were the cap had been standing.

The brown stuff is dried up electrolyte, and its presence outside the capacitor is clear evidence that there's no electrolyte left inside the cap itself. And without electrolyte inside, there can be no capacity, or at least, very little. In this case it measured only 3.2uF, a long way short of the necessary 100uF!

A new capacitor soon restored the vertical scan to normal, and there was no need to look again at that capacitor in the linearity circuit. Having solved the problem, and settled down with a well-deserved cuppa, I found myself wondering how the output coupling capacitor could stop the oscillator from working. They are at opposite ends of the vertical system, and any connection between them is not readily apparent.

In fact, the more I looked at TR601, the less able I was to explain how it could oscillate anyway. At first glance it's just a simple transistor amplifier, with none of the requisite phase-shifting network needed to make an oscillator.

Then I did a mental sidestep and realised that what I was looking at was simply an astable multivibrator. An AMVB usually consists of two transistors, cross-coupled base to collector and collector to base. My mental sidestep was to consider the coupling as 'output to input' rather than as collector to base.

TR601 is emitter coupled to the output by way of the height pot and C607. The second 'transistor' is not one but two units, TR633 and TR634, with the cross-coupling taken from their output at the junction of their emitter resistors, via C611, R603 and C603 to the input of TR601. TR's 631 and 632 are in the oscillator loop, but they are effectively just two inverters in series.

So although this circuit looks nothing like the conventional multivibrator, it really is just another version of that very common circuit. And of course, once it is visualised as such, it becomes easy to explain why an open circuit C611 stopped the oscillation rather than only stopping the output.

Say that again?

Next, I thought I'd share with you this gem which I found in a Sharp service manual. In describing the set's safety circuits, the author wrote:

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In order for the model CX-1463 to ensure its best and safe performance in any case, it is provided with the protector circuits whose operations are here explained.

If the unit happens to be put in an accidental state, each of the protector circuits begins to work so as to shut off the power supply to the horizontal oscillator and drive circuits: with the horizontal circuit put in a stop, the whole of the unit is got rid of the trouble escaping from the accident.

Well, I know what he said, but is it what he meant?

The digital future

Then, on to another brief item about a future subject that may well appear in these pages in a year or two....

In one respect, I'm rather glad that I'll soon be retiring and won't have to worry about the new generation of TV sets now coming onto the market.

I recently attended a seminar in Melbourne and one of the subjects under discussion was 'Digital TV'. Originally, I had thought that this meant that the video information was processed digitally, then displayed on a more or less conventional TV set. What I wasn't prepared for was to hear that every aspect of set operation was to come under digital control.

It appears that with the latest sets only the focus control is mechanical. Every thing else has been reduced to software, saved in one of two large EEPROMs.

The set described to us at the Seminar was a hypothetical chassis, a compilation of features from several forthcoming models, but typical of the way the industry is going. We were assured that very shortly we would be faced with just one 'international' chassis, covering all screen sizes and all world TV systems. Only the EEPROM would need to be changed to convert a chassis from a small screen PAL set to a large screen NTSC one.

One problem that was outlined to us was that of changing major components. If it was necessary to change a board, say, after a major burn-up, then the old EEPROM containing the control information and user preferences had to be removed and fitted to the new board. Apparently, it would otherwise be necessary to reset every parameter, even to realigning the tube — since all of these functions are taken care of by the digital circuitry.

Similarly, if it is necessary to change the picture tube, and since all the characteristics of the original tube, such as width, height, convergence and pincushion adjustments, linearity, etc, are all saved in the EEPROM, once the tube is changed these details became meaningless. A complete realignment has to be done and the new values saved in the memory.

Another feature that might not please the consumer is an automatic grey scale adjustment. It seems that the set has the facility to measure the emission of each of the three guns, once in every field. After the initial setting up, the digital circuitry will monitor the colour balance 50 times a second and will adjust the circuit parameters to maintain the grey scale at the desired level. In one way, this is a marvellous facility. The set should produce perfect pictures month after month after month. There's just one snag!

The software that controls all of this marvellous circuitry is also said to contain a lock that prevents the display of any picture that is not perfect. So after five years or so, when the tube emission has drifted and been corrected up to the limit of the control system, the software shuts things down and will not thereafter display any sort of a picture. Apparently, we must then buy a new tube — or a new TV!

When you think of the weird pictures that many owners tolerate, usually for years after the tube has given up any trace of reasonable colour balance, one wonders how they will like having to buy a new tube — just because the microprocessor says the picture is no good!

As I said at the start, I'm glad that I will soon be getting out of active servicing. I'm also glad that my (relatively) new TV should also see me out — without the risk of a shutdown just because the grey scale has gone a bit green!

And finally, the VERY last word on those NEC line output transformers.

Since I wrote in the July '93 edition about the Nasty NEC, and followed it up in the November edition, I've been assailed from all quarters by aggrieved parties. Most complainants have been servicemen, trapped as I was by the 'line output transformer that wasn't the right one'. Others have been NEC service agents, who berate me for not using 'approved replacement parts' supplied by the manufacturer. And yet others are simply colleagues, who said "Thank Heavens I don't mess about with those sort of things!"

Perhaps most telling of all was the comment I got from the manager of the NEC service department in Victoria, when I was able to have a few quiet words with him after the recent seminar.

We were both stone cold sober at the time, but if we had met in a bar, I'm sure he would have had tears in his eyes. "It wasn't our fault", he said, "We were just as much in the dark as you were!"

It seems that the original fault lies with Daewoo in Korea. It was they who made the chassis for NEC, and they who wrote the service manual. They told no-one that other sets carried line output transformers with (almost) identical part numbers, and in the beginning, NEC had just as much trouble with replacements as I (and others) did. So much for 'manufacturer approved' parts!

For their part, NEC learned of the answer earlier than most of us, and of course, they advised their service agents. But the cure for a problem like this takes months to make its way around the traps, and in the meantime ill will flies hither and yon.

I don't know what the answer is. Our customers want their TV's fixed, pronto, and no amount of excuses will satisfy them. Yet the serviceman, the retailer, the distributor, the wholesaler, the (nominal) manufacturer, the importer (and who know who else) are all at the mercy of a faceless manufacturer in some far off country. There's no answer that I can see. We'll just have to develop a thicker skin and learn to live with it...

And by the way — I've just noticed that a new catalog issued by one of the bigger parts suppliers still lists only the DCF1577 transformer, without any suffix. If you ordered from that firm you'd have only a 33% chance of getting the right one! Not very good odds, is it?

That's all for this month. There'll be more from our contributors next time — watch for it. ❖

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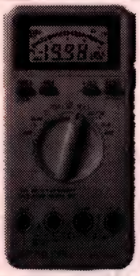

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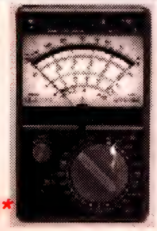

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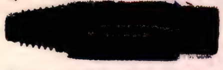

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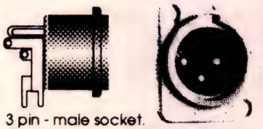

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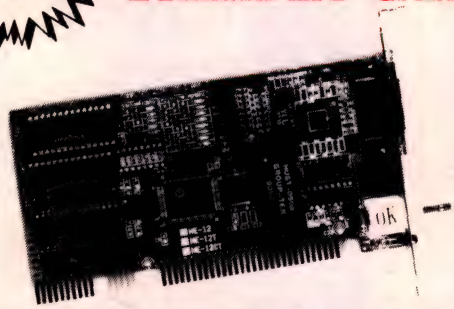

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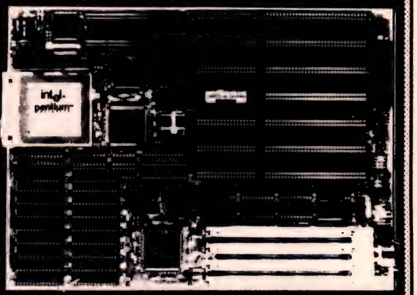

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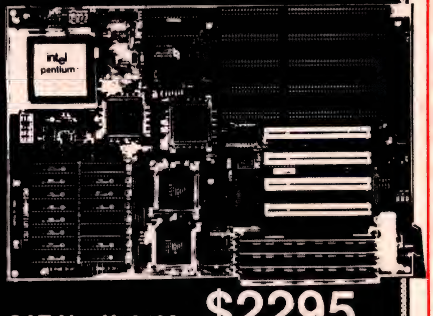

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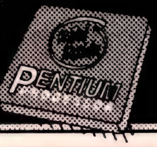

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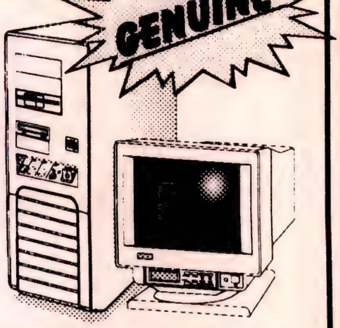

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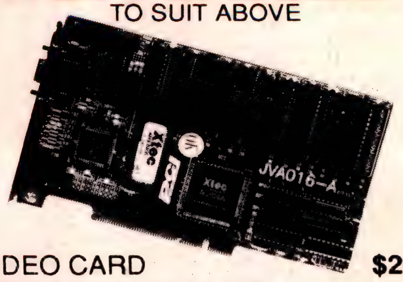

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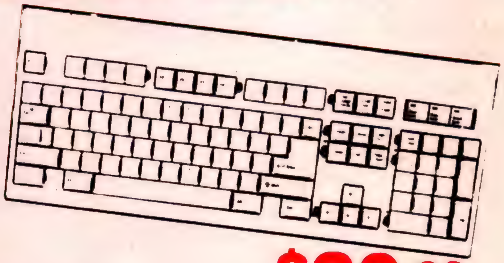

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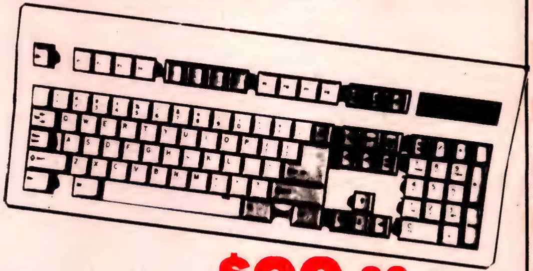

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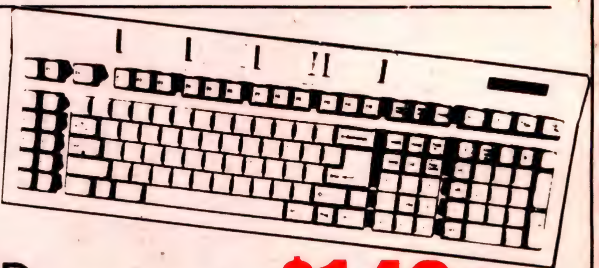

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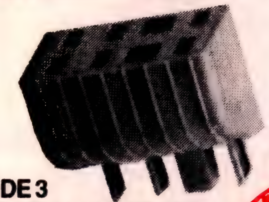

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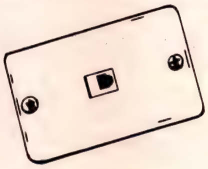

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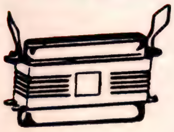

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50 pin Centronics male to female

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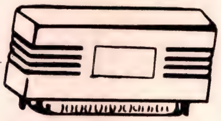

NEW

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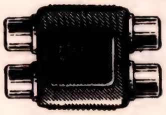

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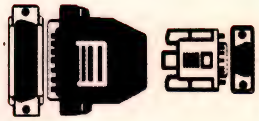

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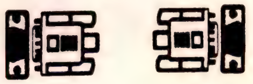

NEW

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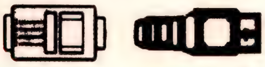

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Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

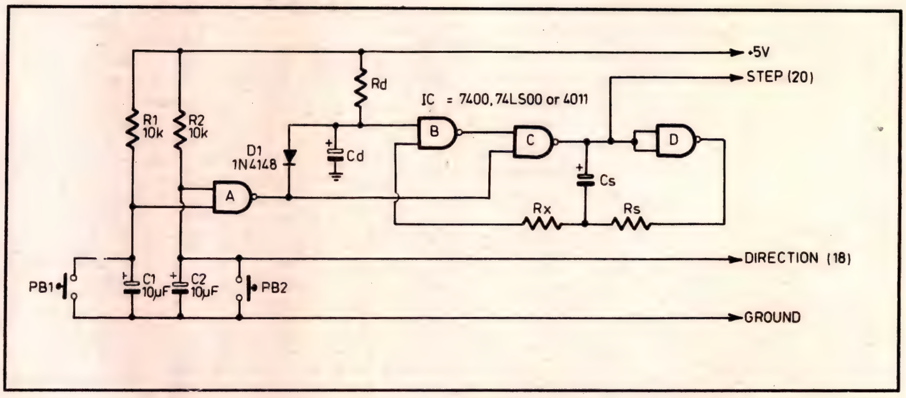
Disk drive stepper motor driver

A retired floppy disk drive, especially a sturdy 5.25 inch full height type, offers the chance to experiment with a stepper motor without having to worry about how to generate the waveforms needed by the stepper. The DC motor and data circuitry can be defunct; only the controller ICs and the stepper motor need be functional.

Remove the controller board and stepper from the drive. Note the connector position if reconnection is likely. A 5V and 12V power supply is needed and feeds the four-pin power connector. On the 34-pin edge connector, the odd numbers are on one side and are all connected to ground. Pins 1 and 2 are closer to the polarising notch of the connector. Select drive position 1 on the drive ID jumpers or DIP switches, then connect pin 10 of the edge connector to ground. Pin 18 determines the stepper motor direction, and pin 20 should be sent a negative going edge for each step.

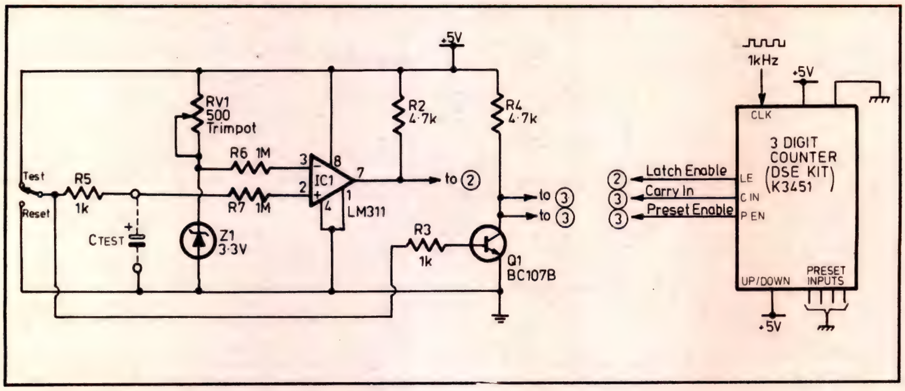
The circuit shown here simplifies control of the stepper. One button causes the motor to step up and the other makes it step down. Additionally, if a button is held down for more than a second, the stepper autorepeats. Gates B and D form a low frequency oscillator. Rs and Cs control the stepping frequency, while Cd (also Rd for CMOS) determine the delay between single and repeat stepping.

The table shows component values for different types of logic gates. For TTL vary the capacitances, for CMOS change the resistances. Uses are up to your imagination and could include motorised curtains, robotics and so on.



logic type	Rs	Cs	Rx	Rd	Cd
TTL	1.5k	47µF	0	22k	470µF
TTL LS	6.8k	10µF	1k	100k	100µF
CMOS	680k	100nF	0	330k	10µF

K. Yap
Lane Cove, NSW **$45**



Simple capacitance meter

The circuit works on the time constant principle, where t = RC. After one time constant, the capacitor voltage will be 63.2% of the supply voltage. This voltage is applied to pin 2 of comparator IC1. RV1 is adjusted to give 63.2% of the supply voltage (about 3.15V) at pin 3 of IC1. When the capacitor voltage reaches (and just exceeds) the voltage at pin 3, the comparator will change state and its output will go high. This voltage is applied to the latch enable terminal of the 3-digit counter available as a kit from DSE (cat no K3451). This counter also needs an external clock signal.

Because the value of R5 is 1k, the value of the capacitor is determined by the equation C = t/1000. If the clock is 1kHz, the capacitance value (in microfarads) equals the number of clock pulses. For instance, if C is 680uF, then t = 0.68 seconds and 680 clock pulses are read by the DSE counter module.

The counter advances by one at the positive transition of the clock when the carry-in and preset-enable signals are high. The up/down terminal should be high for a count-up. All preset inputs should be connected to ground so the counter is reset to zero when the switch is in the reset position. This position also discharges the capacitor.

The ideal measuring range is between 10uF to 999uF, but could be adapted to other ranges by changing the value of R6 and the clock speed. For example, if R6 is 10k and the clock speed is 10kHz, the measurement range is 10 to 999nF.

P. Hetrelezis
Vermont, Vic. **$45**

If you've developed an interesting circuit or design idea, like those published, why not send us the details? As you can see, we pay for those we publish — not a fortune, but surely enough to pay for the effort of drawing out your circuit, jotting down some notes and sending the lot, together with your name and address to Jim Rowe, Electronics Australia, PO Box 199, Alexandria NSW 2015.

NiCad charger with peak voltage detection

This circuit will fully charge NiCad cells, then switch over automatically to trickle rate, by detecting the slight drop in cell voltage just beyond the full charge. It was developed to charge AA cells, but with slight changes, could be adapted to other cell sizes.

With a battery connected and power first applied, C2 is discharged, so pin 3 of IC1 is low. Pin 2 is high, which drives pin 1 low, so both Q1 and Q2 will be off. This allows Reg.1 to deliver the main 200mA charge to the battery through D5, while R5 supplies 3mA via D4, the main charge indicator. Close S3 for a 500mA main charge current. To alter the main charge current, change R6, R7 or R8.

R14 keeps Q3 turned on, which prevents Reg.2 from operating by grounding its adjust terminal. As the battery voltage rises, C2 charges through R2, and the voltage across C2 follows the increasing battery voltage. For the values of R2 and C2 shown, the capacitor voltage will be about 50mV below the battery voltage.

At full charge, when the battery voltage stops rising, the capacitor voltage catches up to it, and when the voltage on pin 3 is within 2mV of that on pin 2, the output is driven high and latched by D3, which keeps pin 3 high. Q1 now turns on, disabling Reg.1.

This causes Q2 to saturate, which turns off Q3, removing the clamp from the adjust terminal of Reg.2. The circuit now delivers a trickle charge of 21mA to the battery, set by R12. R10 supplies 3mA of this current, via the trickle charge indicator LED D6.

D8 ensures Q3 is off while Q2 is on by keeping the emitter voltage of Q3 higher than its base voltage. Up to about 18 cells can be charged in series, governed by the 32V maximum rating of IC1 (an LM358), and allowing for a 3V voltage drop across the charging circuit.

The 200mA main charge rate is a compromise between the C/3 rates of the 500mAh and 800mAh range of AA cells. The 21mA trickle rate also suits this range, as it should be between 0.02 and 0.05 of the cell capacity. The trickle charge counters self-discharge, and may be left on indefinitely.

Partially discharged cells can also be charged, with the assurance that the main charge will terminate at the right point. (At least one manufacturer claims his cells have very little memory effect.) Should the circuit switch over to trickle rate too soon, try increasing the main charge rate. Also increase either R2 or C2, as this time constant is for a minimum rate of C/3.

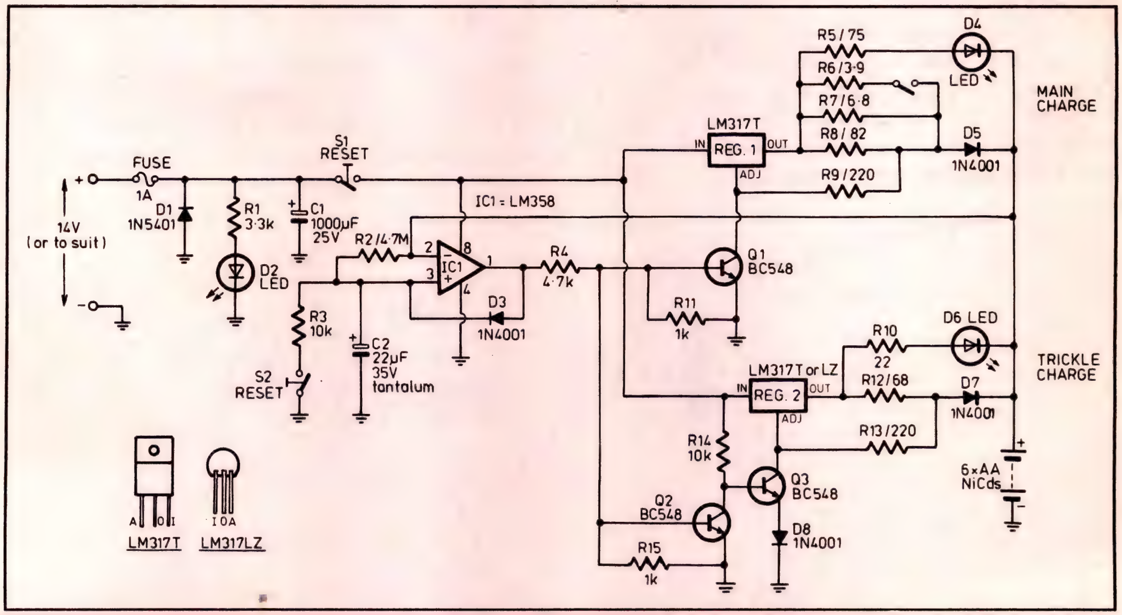
If the early changeover keeps occurring, one cell may be peaking before the others, due to lower capacity, so a fixed time charge may be the only solution. The main charge can be restored by pressing S1 and S2 at the same time, which are normally-closed and normally-open pushbuttons respectively.

This will remove the latch from IC1, and most of the charge from C2. D1 and the fuse provide reverse-polarity protection, and D2 is a power-on indicator. The LEDs are 3mm types, and all resistors can be 0.25W 5% types, except R7 (0.5W) and R6 (1W). Reg.1 might need a small heatsink.

This circuit was originally designed to charge Metz 45 packs, but when charging this pack at 500mA or more, connection should be made directly to the battery, via the top terminals, and not to the normal charging pins, as the internal 400mA rated lamp could be damaged.

N. Boyce
Panania, NSW

$50



Simple solar cell voltage regulator

This unit was constructed two years ago as a cheap means of limiting the current supplied by a solar panel to a car battery. It has operated without any trouble since that time.

When the battery voltage is below about 12.8V, the charging current passes through the closed contacts of the relay, giving the full supply available from the solar cell. When the battery voltage rises to about 13.8V, the zener diode conducts and supplies base current to Q1, switching on Q1 and energising the relay. The relay contacts therefore open and the charging current now passes through the 12V 15W lamp, R1. This allows only a trickle charge to the battery and is partly self-regulating — the higher the current the higher the lamp resistance and vice versa. When a load is applied to the battery, the battery voltage drops below 12.8V, the zener diode stops conducting and Q1 switches off. The relay is then de-energised and the relay contacts close, giving full charge to the battery. RV1 is adjusted to give the correct change-over voltage.

N.W. Riley
Rossmoyne, WA

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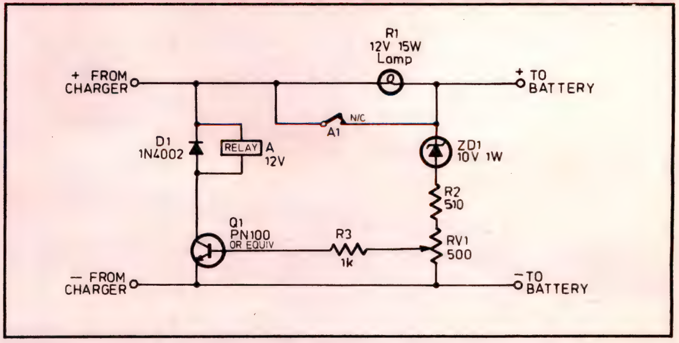


Construction Project:

General-purpose digital panel meter

This updated version of the popular digital meter described in June 1990 features a single polarity DC supply, audible over-range indicator and very high stability.

by JEFF MONEGAL

A general purpose digital panel meter like the one presented here has many uses. Replacing the analog meters in your workbench power supply is a typical and useful example. But unlike many similar modules, because it can be powered directly from a 12V DC source, this project can be used in a car as an indicator of battery/alternator activity. Or perhaps add a temperature probe, to measure temperature.

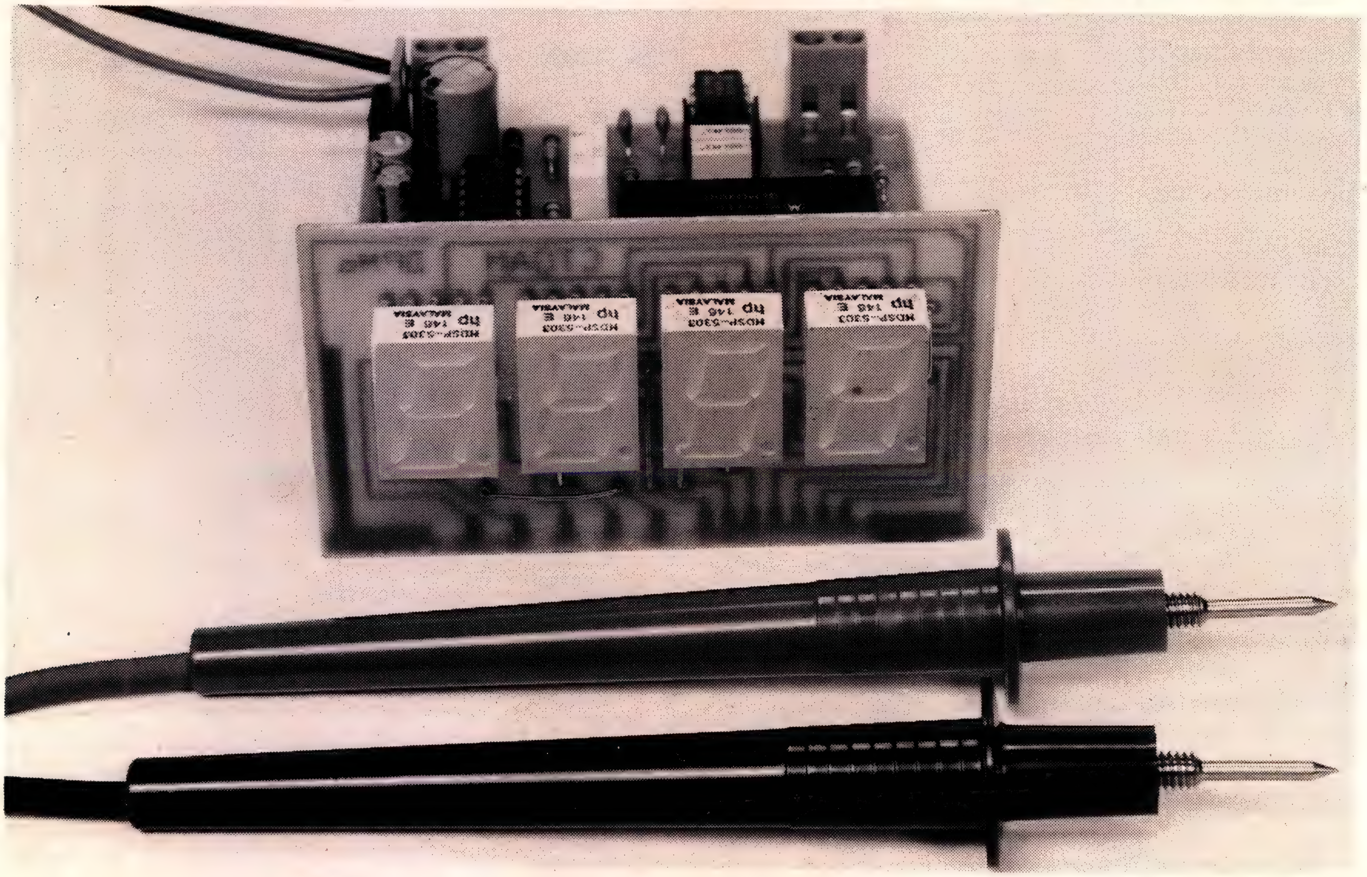
By adding scaling resistors in a voltage divider configuration, the meter can be converted to a voltmeter with ranges anywhere from 200mV to over 2000 volts. Add a few shunt resistors and the meter is an ammeter able to measure milliamps to 20A or more. The analog to digital converter IC used in this project is the Motorola MC14433, the same as in the previous design. However, the reference voltage to the ADC is a precision reference IC, type MC1403, compared to the zener diode reference used in the June 1990 version.

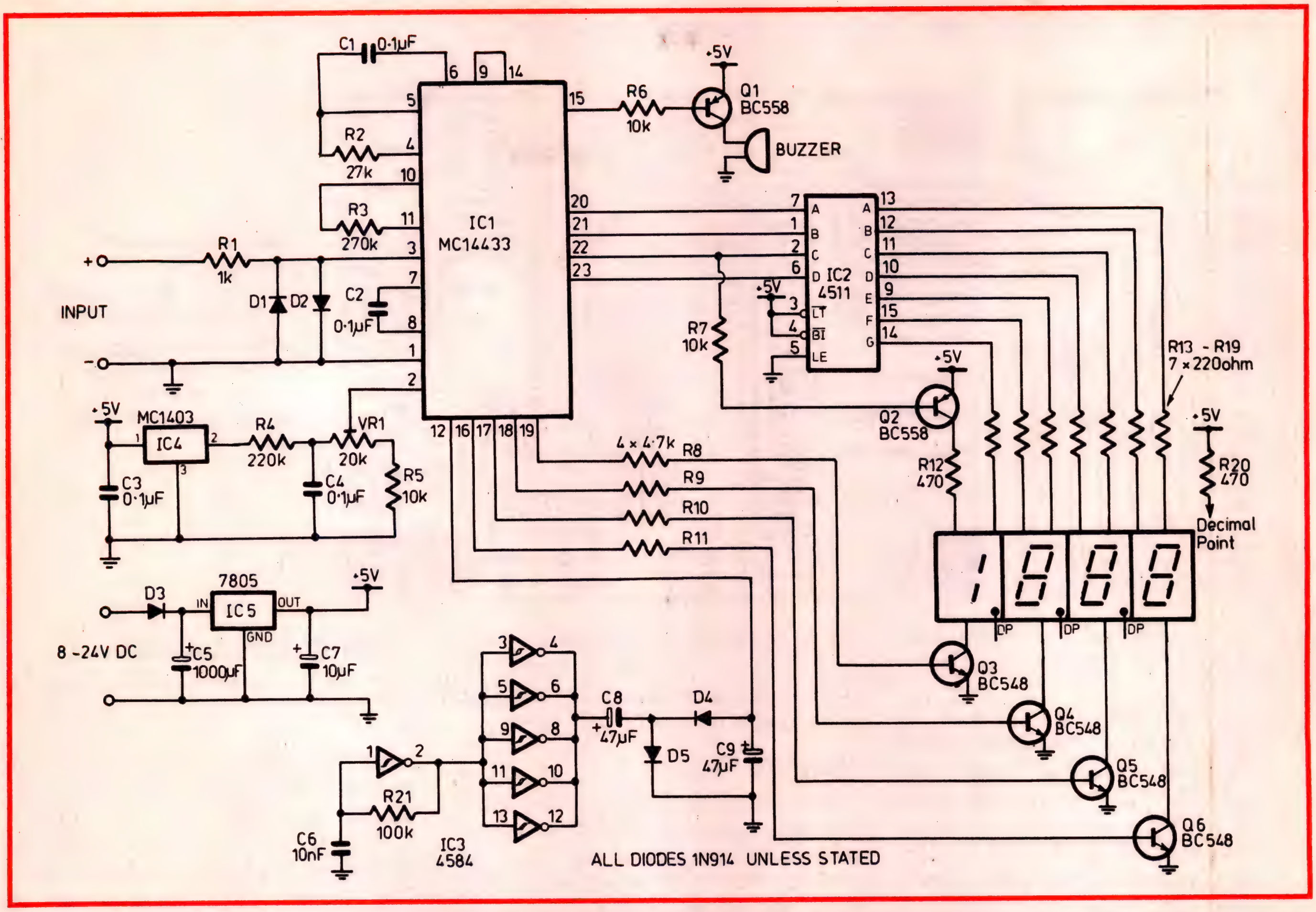
Another important addition is an onboard negative rail generator. This allows the meter to be powered directly from a single 8 - 24V DC supply.

So how does this new design perform? The MC1403 reference IC is specified as having a worst case maximum change of 4.4mV over a temperature range of 0° to +70°C. However this change is for a 2.5V output from the IC. In this project, the 2.5V is divided down to 200mV, so the actual change in the reference will be about 400 microvolts.

This doesn't take into account any change in value of the components used in the reference divider, but tests have shown that the meter reading doesn't change over the temperature range of 0° to 55°C.

The meter has auto-polarity, with segment 'g' of the most significant digit used to indicate a negative value. Over-range indication is also included, but rather than the usual flashing or blanked-out display we've used a small 'soft tone' piezo buzzer. You don't have to be watching



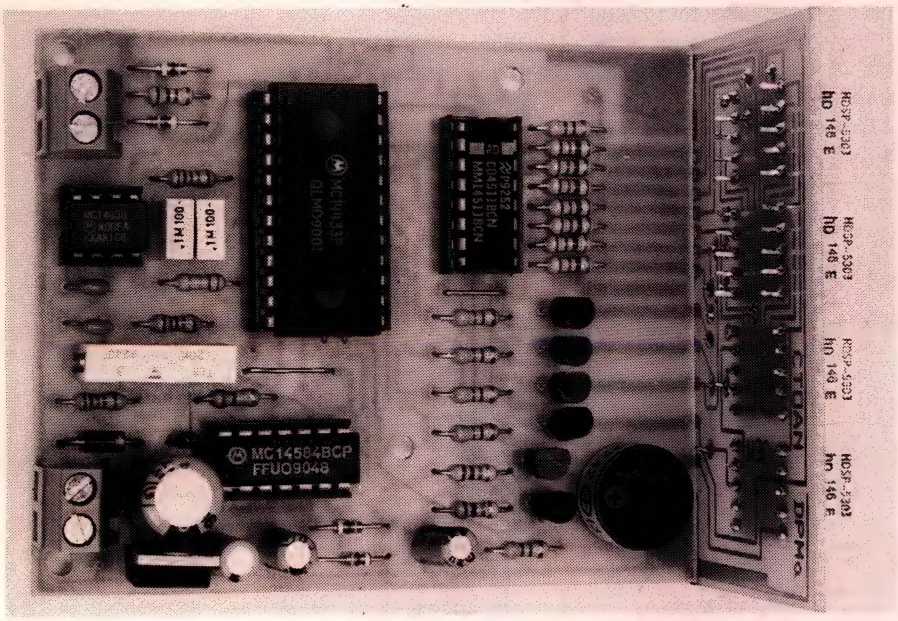


The circuit diagram. The A to D converter is IC1, and IC2 decodes the BCD data from IC1 to seven segment data for the displays. The negative power rail is developed by IC3, and the reference is IC4.

the display to know that the input voltage is over range.

How it works

Most of the work takes place inside the dual-slope analog to digital converter IC1. The integration components are C1 and R2 and with the values shown, the circuit gives about four conversions per second. Resistor R3 sets the internal clock frequency to about 66kHz. Resistor R1 together with diodes D1 and D2 ensure that the input to the ADC cannot exceed +/-600mV.



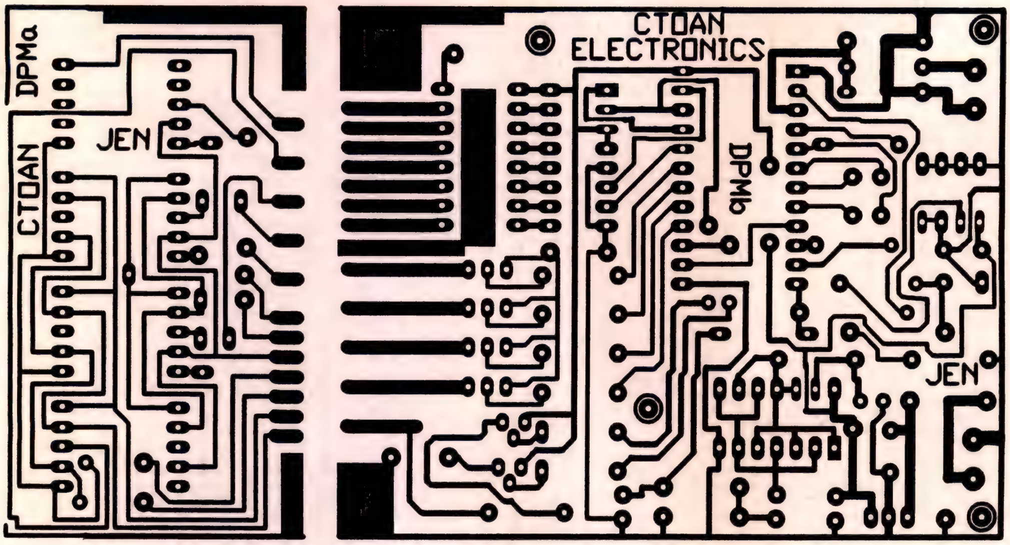
This close-up view of the main PCB shows the display board attached to the main board.

The reference for IC1 comprises IC4 and associated components. The MC1403 was chosen as it is cheap, readily available and has excellent specifications. It gives a 2.5 volt output at pin 2, with a variation of +/-25mV over the temperature range of 0° to 70°C.

Components R4, VR1 and R5 divide the 2.5 volts down to the required 200mV for the reference needed by IC1. Therefore the full-scale input voltage to the meter is 200mV; or more precisely, 199.9mV. Needless to say, R4 and R5 are 1% metal-film resistors and VR1 is a cermet multi-turn trimpot.

The over-range output of IC1 is pin 15, which goes low when the input exceeds 199.9mV. This turns on Q1, via R6, which sounds the buzzer when there's an over-range condition. Because the module has auto-polarity, segment 'g' of the most significant display (MSD) is used to indicate a negative input voltage. Under this condition, pin 22 of IC1 will be low during the on-time of the MSD display (driven on by pin 19). Tran-

General-purpose digital panel meter



The PCB pattern is reproduced here actual size for individual constructors only. The pattern is copyright to CTOAN Electronics. See end of article on how to purchase a kit.

sistor Q2 is turned on by a low at pin 22, in turn supplying current to segment 'g' of the MSD.

IC1 outputs BCD data on pins 20, 21, 22 and 23. This data is fed to IC2, which decodes the BCD information into 7-segment data. The LED displays are multiplexed by IC1 via display switching transistors Q3 - Q6. So IC1 can function with negative input voltages, it must have a negative supply rail.

In the previous design, the negative supply had to be provided externally. In this design the negative supply is generated by IC3, a hex inverter with Schmitt trigger inputs.

IC3a is wired as a standard Schmitt relaxation oscillator and its output is buffered by the five parallel connected gates. These gates drive a charge pump circuit consisting of components C8, C9, D4 and D5. Here the AC signal developed by IC3 charges C9 in a negative direction, producing a negative voltage of about 4V which is then fed to pin 12 of IC1. Power to the overall circuit is regulated by IC5, a TO220 5V regulator. Diode D3 provides reverse polarity protection while C5 smoothes the incoming DC supply.

Construction

Because some of the links are under IC1, these should be fitted first. Next fit all resistors, capacitors and then the diodes and transistors. As usual, carefully check the orientation of the diodes and electrolytic capacitors. We used IC sockets in the prototype, and these should be fitted last, followed by the voltage regulator. Use a small soldering iron, as there are a few tracks running between IC pins.

When assembling the display PCB, insert the links first as there are two under the displays. The four displays are inserted with the decimal point at the bottom of the board. The display board is soldered at 90° to the main PCB. Make sure that the two boards are aligned properly before you solder them.

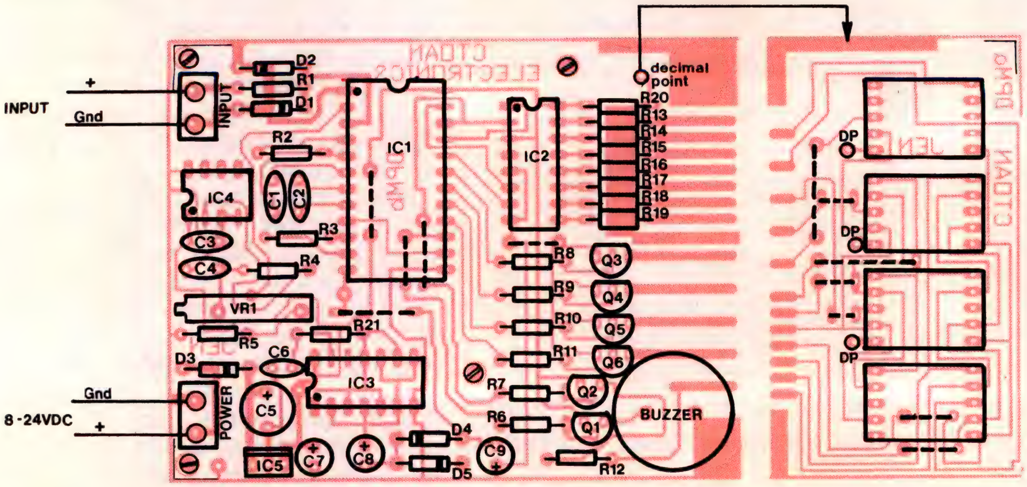
Testing and calibration

To test the meter, connect a suitable DC supply to the PCB, as shown in the layout diagram. The voltage can be anywhere between 8V to 24V. When power is first applied, the over-range buzzer will beep and the display should show close to zero, with the least significant display changing value. The current consumption should be around 50mA.

To calibrate the meter, connect a DC voltage source that can be adjusted below 200mV. Monitor this voltage with another DVM of known accuracy and adjust the voltage to say, 100mV. Then adjust the potentiometer until the display agrees with the DVM. Once this adjustment is made, that's it.

Applications

Because this meter is an update of a previously published project, rather than repeat ourselves, we recommend you



There are a few links under ICs and displays, so fit the links first. The decimal point can be fixed for a single scale meter, or switchable via a three-way switch.

PARTS LIST

Resistors

All 1/4W, 5% unless otherwise stated

R1	1k
R2	27k 1% metal film
R3	270k
R4	220k 1% metal film
R5	10k 1% metal film
R6,R7	10k
R8-11	4.7k
R12,R20	470 ohm
R13-19	220 ohm
R21	100k
VR1	20k 10-turn cermet trimpot

Capacitors

C1,C2	0.1uF mylar
C3,C4	0.1uF mono
C5	1000uF 16V electrolytic
C6	10nF mono
C7	10uF 16V electrolytic
C8,C9	47uF 16V electrolytic

Semiconductors

IC1	MC14433 3.5 digit ADC
IC2	4511 seven-segment driver
IC3	4584 hex Schmitt inverter
IC4	MC1403 precision reference
IC5	7805 T0220 5V regulator
D1,D2,D4,D5	1N914 signal diode
D3	1N4004 power diode
Q1,Q2	BC558 PNP transistor
Q3-6	BC548 NPN transistor
DIS1-4	HDSP 5303 seven-segment LED display

Miscellaneous

PCB, 90 x 70mm coded DPMb; PCB, 90 x 40mm coded DPMa; PCB-mount 'soft tone' piezo buzzer; two by two-way PCB mount terminals; IC sockets to suit if required; solder; wire for links; mounting screws as needed.

CTOAN Electronics is offering this project as a kit for $50.00, which includes all components, including buzzer, four displays and both PCBs. Postage and handling is $5.00 to anywhere in Australia. A repair service is also available for this kit. Cost of any repair, excluding IC1 replacement, is $20.00 which includes return postage. Fully built and calibrated kits are also available for $79.00 including postage.

Kits may be ordered using B/C, M/C and Visa cards as well as cheque or money order from:

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Phone (07) 297 5421

refer to the June 1990 edition of *EA*, pages 132 to 138. (Photocopies of this article can be obtained through our Reader Services Office.)

This article gives a more expanded description of the operation of IC1, and gives more detail on how to convert the meter to a voltmeter or an ammeter.

Remember that this design doesn't include space on the PCB for the scaling components. However these are easily fitted to a range switch.

As for the previous design, the full-scale input voltage is 199.9mV, so the scaling circuits given in the previous article apply to this project. ❖

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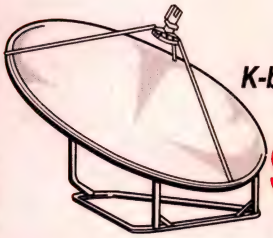

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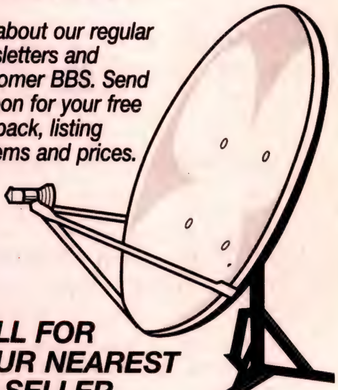

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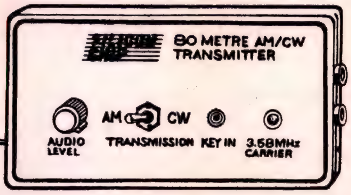

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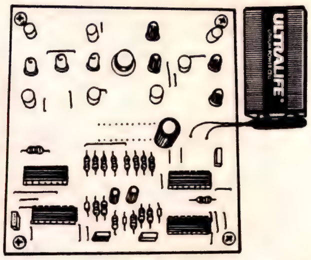

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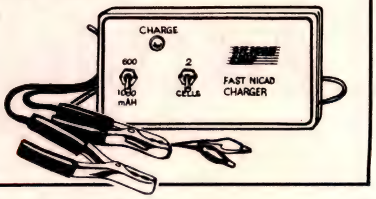

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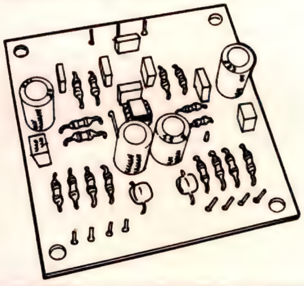

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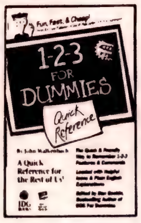

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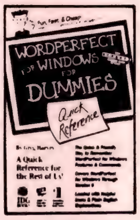

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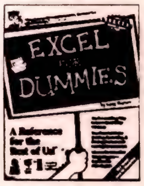

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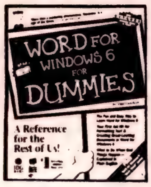
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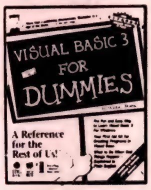

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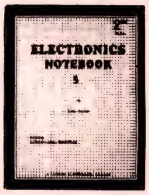

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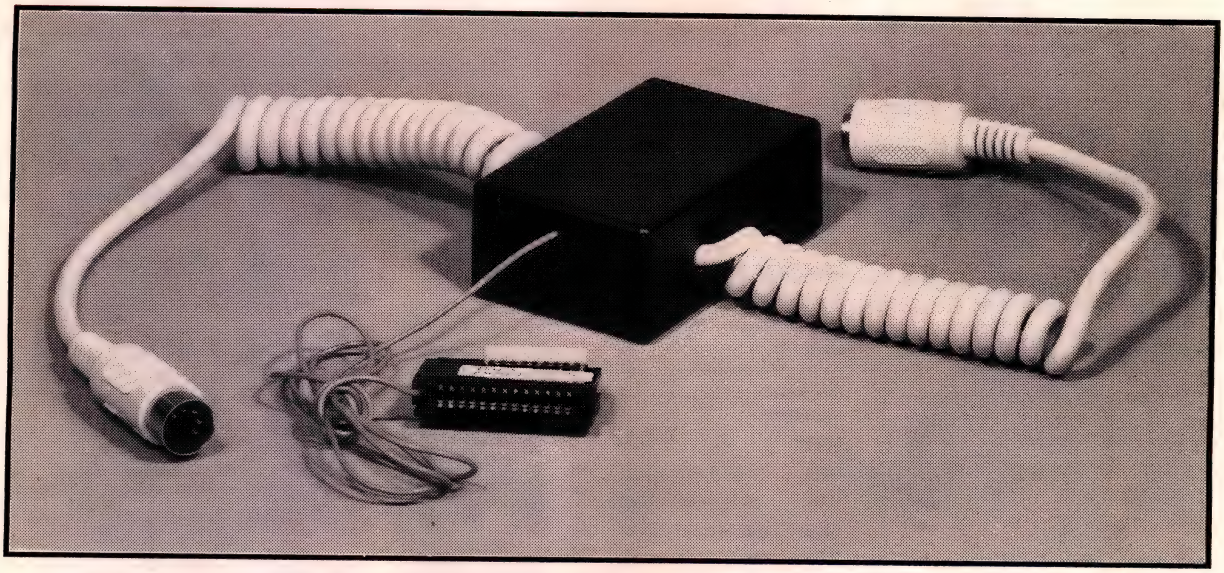


A HARDWARE SCREEN SAVER

If your PC is fitted with an expensive video monitor, you shouldn't leave it displaying a bright static image on the screen. A 'screen saver' program is the popular remedy, but these can cause conflicts with some applications packages. Here's a simple low cost project which does the job quite 'transparently', using hardware rather than software. It works with many 'IBM clone' PCs and popular VGA cards...

by DAVID JONES

It's a well known fact that leaving the same picture on a monitor for extended periods of time can 'burn' the image into the phosphor coating on the inside of the picture tube screen. This leads to washed-out or faded areas on the screen, and necessitates the need to turn the brightness and contrast up — which in turn causes more damage and shortens the life of the tube. A rather grim tale, and the last thing you want to happen to your brand new, whiz-bang multiscan colour monitor that cost you a second mortgage on the house.

Fortunately there is an easy solution: a 'screen saver' program which turns off the picture on the monitor when the keyboard has not been touched for a preset time period. This allows you to walk away from the machine, safe in the knowledge that the screen won't be left on at full brightness for hours on end.

Screen saver programs are the latest craze at the moment. They come in all different shapes and sizes, from simple ones that just turn the screen blank, to full colour graphics of tropical fish, paddling ducks, flying toasters, scenes from popular movies or just about anything else you can think of.

The problem is that these programs must be either built into the application that is running (there's not too many of these), or in the form of a TSR program that takes up memory and can cause possible conflicts with some software applications.

Wouldn't it be great if you had a screen saver built into the hardware, so that it would work totally transparently to all programs, and wouldn't use one bit (pun intended!) of memory?

Well here it is — a hardware device that connects to almost any clone PC with a keyboard and a VGA card with one of the so-called 'feature connectors'.

The unit can be programmed via jumper links, to time for any period from a few seconds to many hours of non-keyboard activity before the screen blanks out. Another jumper selects between a totally blank screen, or one that flashes on and off every couple of seconds. Pressing any key on the keyboard will cause the screen to switch back to the normal display, exactly where it left off.

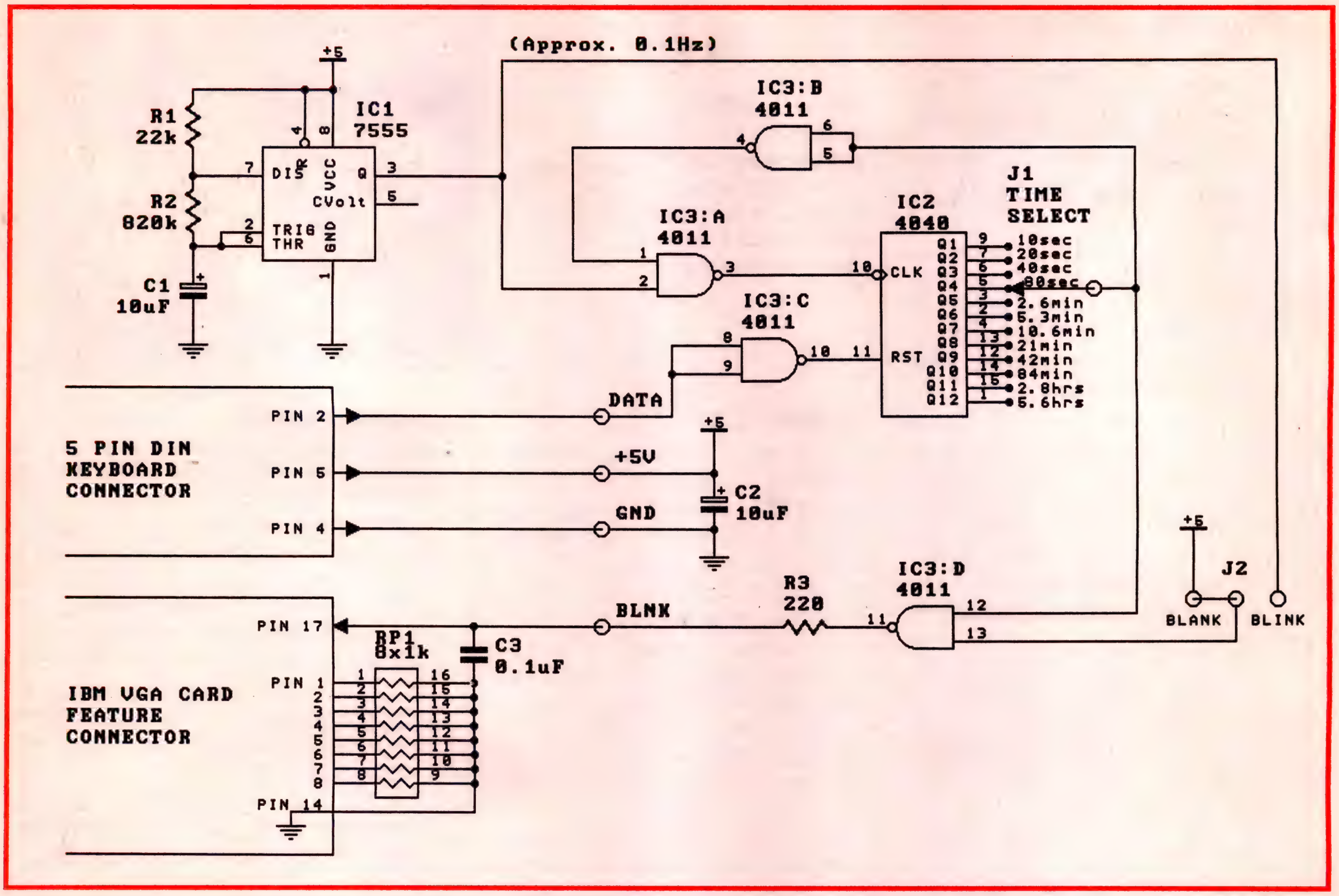
The device fits in one of the smallest jiffy boxes (UB5) and takes its power from the keyboard port, which is also used to sense keyboard activity. There is only a single other wire that goes to the VGA feature connector, which is a 26-way card edge connector located on the top edge of most VGA cards.

How it works

First up, it may be best to describe in basic terms how the VGA feature connector works. Basically it is an external port which provides access to all of the sync and digital colour bits.

The lines that we are interested in are the 8-bit data bus (pins 1 - 8) and the data bus direction line (pin 17).

Pin 17 is tied high on the VGA card, and this sets the data bus to an output



There's very little hardware in the screen saver, as you can see. Low frequency oscillator IC1 drives counter IC2, which produces blanking of the screen by controlling pin 17 of the 'feature connector' on your VGA graphics card. If there has been no keyboard activity to reset the counter via IC3c, the screen is blanked

which contains all the colour information generated by the DAC chip on the VGA card.

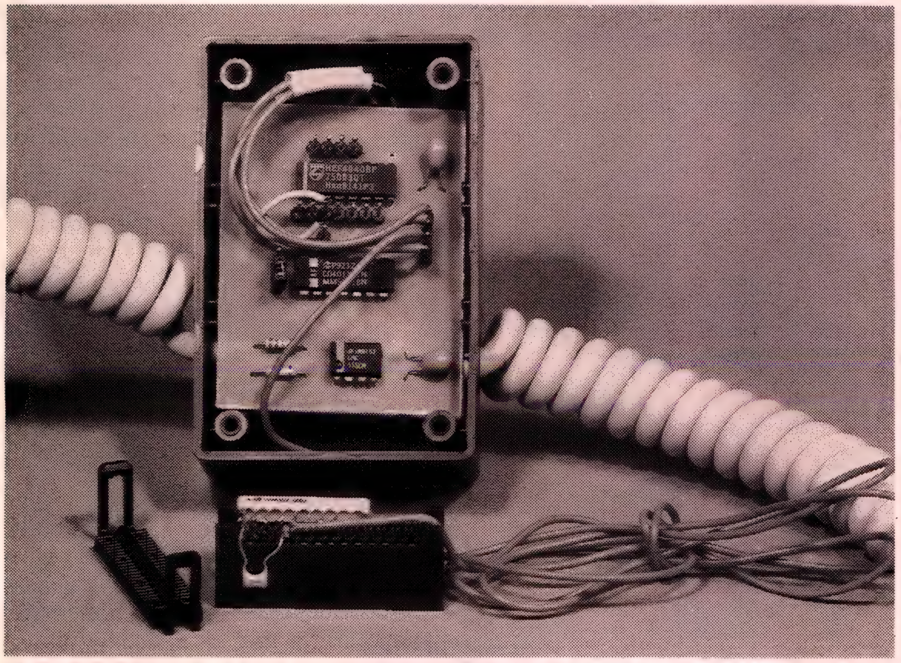
However if pin 17 is pulled low, then this selects the data bus as an input. Therefore in this mode 8-bit colour data information can be fed in externally via this port, and displayed on the monitor instead of the data from the DAC.

Regardless of the state of pin 17, the sync signals will still be generated internally and all we are doing is selecting either the colour information from the computer or an external one — which in this case is the colour black, because we tie all the data bits low via resistor pack RP1 (see schematic).

You may have guessed that it would be possible to 'blank' the screen with any colour we choose, simply by applying the correct colour bit pattern to the bus. But that really defeats the entire purpose of a screen saver!

The feature connector also contains external sync lines, which could have been used to blank the screen also. All you have to do is select external sync and then not apply any! But this can cause some multi-sync monitors to switch to their lowest scan frequency — which is usually 15.625kHz. As a lot of people can hear this frequency, it can become quite discomforting!

So now all we need is a circuit that times for a certain period of no keyboard activity and then sets pin 17 of the



This view shows inside the author's prototype unit, which was fitted in the centre of a keyboard extension cable. Also visible at the bottom is the 26-way connector used for the VGA card interface, showing the added components.

Screen saver

feature connector low. Which in turn will fill the entire screen with the colour black, thanks to RP1. Simple, huh?

This is exactly what is done by the simple circuit described here. Here's what happens:

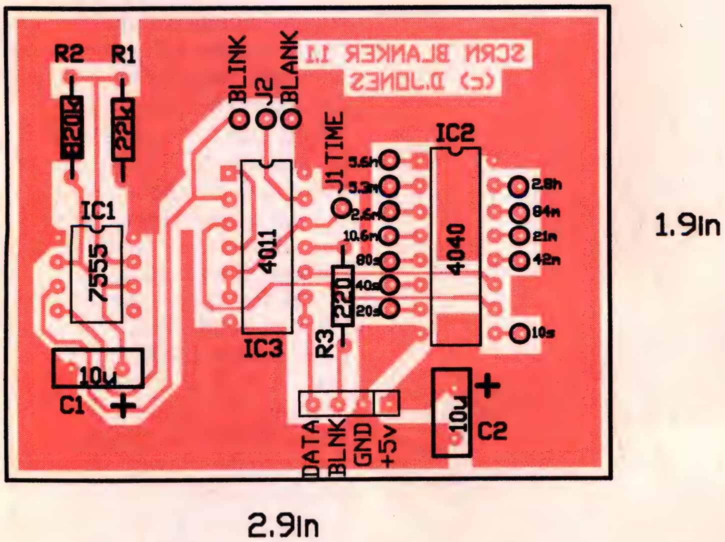
IC1 is a simple oscillator producing an output of 0.1Hz or thereabouts, which feeds into the binary counter of IC2 via the NAND gate IC3a, which we will assume is initially enabled. This will slowly clock the counter.

Pin 2 of the keyboard port is the data line, which is normally high; but if a key is pressed, then a negative-going pulse train is produced for a few milliseconds. This will be inverted by IC3c and will reset the binary counter IC2. The counter will continue to be reset every time a key is pressed on the keyboard.

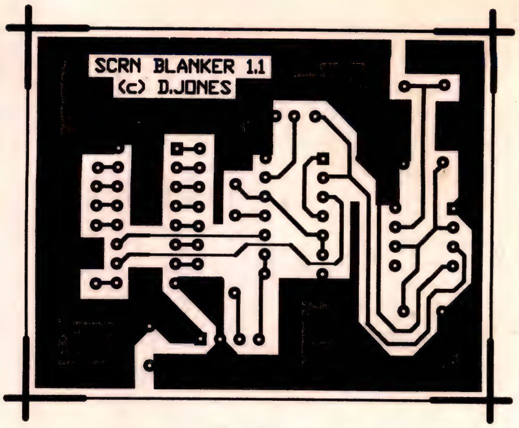
Now if *no* key has been pressed, and the binary counter is allowed to count to the limit set by jumper J1, then IC3b will invert this high counter output and disable any further clock pulses from reaching the counter.

At the same time this high counter output will also set the VGA feature connector's pin 17 low via IC3d, depending on the setting of J2 — which will either toggle the screen off and on at the frequency of IC1, or blank it out completely.

VGA pin 17 will stay in this condition until a key on the keyboard is pressed. This will reset IC2, and the whole process starts over again. As you can see, it's quite straightforward.



Use this overlay diagram as a guide when you are wiring up the saver PC board. Note that the spacing of the connection pins used for both the J1 timing link and the J2 blink/blank selection are spaced to allow use of SIL pinheader strip.



Here's the PCB pattern for the screen saver, as usual reproduced actual size for those who wish to etch their own boards.

Construction

All of the components, with the exception of RP1 and C3, are mounted on a small PCB which fits neatly inside an 83 x 54 x 28mm jiffy box without requiring mounting screws. (RP1 and C3 are fitted to a 26-way IDC card edge connector, which fits on your VGA card's feature connector.) With a small PC board such as this, it doesn't really matter which components are mounted first. All of the IC's are CMOS types, so as usual precautions should be taken with static handling. Watch the orientation of the two capacitors.

The choice must be made now as to what time period and method of blanking are required. J1 and J2 should be linked accordingly. The schematic and overlay diagram show the information for these links.

C3 and RP1 should be mounted on the 26-way IDC card edge connector so they don't interfere with any adjoining cards, when it's fitted in position. Standard resistors can be used in place of RP1, but it just looks neater to use a SIL resistor pack. Pin 1 of the card edge connector is on the component side nearest the back of the VGA card. Pin 14 is opposite pin 1 on the copper side.

Depending on where the blanker will be mounted, the cable that connects to the keyboard port will be either a 5-pin DIN keyboard extension cable with pins 2, 4 and 5 tapped off and taken to the blanker, or a header plug which connects to the motherboard keyboard port. The pinouts for this plug can usually be found in the manual that comes with your motherboard.

When soldering to the 26-way IDC connector pins, watch that the solder does not flow down into the contacts.

Installation

If your PC motherboard has an internal keyboard connector (usually a four-pin header connector), then it would be best to mount the blanker inside the PC. In this case you can save the cost of the DIN connectors. This also won't add to the clutter of cables that are already behind most PCs.

It is best to stick the unit down with double-sided tape, in any place that is convenient. Just be sure to avoid any exposed mains wiring that some PC's have going to the front panel power switch.

Be sure to mount both connectors around the right way, otherwise you may get some very strange symptoms!

If the unit is to be mounted outside the PC, then it's a simple matter of connecting it into the keyboard cable and then running the IDC connector into the case, usually though an empty expansion card slot or 'D' connector cover on the back panel.

Operation

Apply power to the PC as usual and get any sort of image on the screen. It doesn't matter if it's text or graphics. Wait for the time you have preset with jumper J1. It may take slightly less or slightly more time before the screen blanks out, but this is just due to

Continued on page 101

SHORTWAVE LISTENING

with
Arthur Cushen, MBE

Expansion of FM services as ABC shortwave stations close

The closure of ABC shortwave services from Brisbane and Perth recently is understandable as they provided a service for the inland. When compared to the expansion of FM coverage, it is obvious that these parts of Australia are now being covered on that band.

According to a report from the Australian Broadcasting Authority the ABC has increased its number of FM stations from 288 in June 1991 to 420 transmitters in June 1993. On the AM band the ABC has a static situation, with 108 transmitters over this period. Commercial AM radio has reduced the number of frequencies in use from 140 to 127 and on commercial FM increased from 63 to 84 over the two year period.

Following recorded announcements from the ABC stations in Brisbane and Perth on their shortwave services to find the present audience, it is clear that listeners have tuned away from shortwave in the outback and are now covered by an efficient FM and satellite service. Accordingly, the ABC stations VLQ and VLM in Brisbane and VLW in Perth have been taken off the air.

The transmissions from the Brisbane studios of ABC were carried on shortwave on VLQ 9660 and VLM 4920. Located at Bald Hills, the transmission of VLQ commenced in February 1943 using 10kW, while the second transmitter of 10kW, allocated the callsign VLM, commenced operation in September 1949. Prior to 1951 this transmitter was 200 watts and used the 60-metre tropical band. Its coverage was widespred throughout Northern Queensland.

Meanwhile in Perth, at the transmitting site of Waneroo, VLW came into operation in October 1939 with a relay of the ABC mediumwave programme. An additional transmitter was added in 1949 using the callsign VLX and a power of 10kW. In 1959 the whole transmitter site was rebuilt and three new transmitters installed, two of 10kW and one of 50kW. In 1962, the facilities were combined and only one callsign VLW has been used since that date.

The only ABC service for internal reception on shortwave is now located in the Northern Territory, with transmitters at Alice Springs, Katherine and Tennant Creek, and they operate in the 120-metre band: VL8A on 2310, VL8K 2485 and VL8T 2325kHz. While these provide night time coverage throughout the area, higher frequencies are used for daytime operation. As well as these three sites, Radio Australia's overseas service has transmitters at Shepparton, Carnarvon, Darwin and Brandon.

New Berlin signal

For more than 40 years the signal of RIAS (Radio in American Sector) has been broadcasting from Berlin, and was one of the remaining reminders that at the end of World War II Berlin was partitioned into four areas by the governing powers Britain, France, Russia and the United States. RIAS has continued to be received through the world from Berlin on 6005kHz.

In the early days of the Cold War, East Germany attempted to disrupt the signals of the RIAS and the jamming machine — which was later captured — stands in the lobby of the RIAS building. Listening to the forbidden station in East Germany resulted in a prison term.

In 1960 when the Berlin Wall went up, the station changed its format to offer popular music not widely available in Eastern Europe. The United States contributed to the budget of RIAS, which was non-commercial and the station has now been absorbed into a twin network which will have bases in Berlin and Cologne. The network is Deutschland Radio and continues to operate on 6005kHz. Reception has been noted at 0700UTC with news in German, popular English and German music with announcements each 15 minutes. The address of Deutschland Radio is: Hans Rosenthal Platz, 10825 Berlin Schonberg, Germany.

New Peruvian station

Located near Cusco in Peru, a new station is under construction with the slogan Radio Universal; it is being sponsored by a Baptist Mission. The programmes will be locally based and will be in Spanish and Quechua. The plans include taking some satellite transmissions in Spanish, but the Quechua programmes will be locally produced.

When in operation, the station will cover parts of Ecuador and Bolivia as well as Peru. ◆

AROUND THE WORLD

GUAM: KSDA Agat is operating to the following schedule with English broadcasts: 0200 - 0300UTC on 13,720kHz Saturday and Sunday; 1600 - 1700 7455kHz daily; 1700 - 1900 13,720kHz Saturday/Sunday and from 2300 - 2400 on 15,160kHz daily.

INDIA: The expansion of radio services in North East India is the subject of a booklet issued by All India Radio, Shillong, to celebrate their four years of broadcasting. The information includes details of a new frequency in use, 4790kHz which is operated between 1100 -1630UTC. The transmitter in use is 50kW and expansion in services are planned to cover both morning and midday services. The studios are located in a central place in Shillong near Raj Bhavan, the official residence of the Governor. NES broadcasts programmes in Hindu, the official language of India, and in English to the seven states in North East India.

KUWAIT: Radio Kuwait is heard in English at 1800 - 2100 on 11,990kHz. The station has popular music before 2000, then a feature programme. From 2030 - 2100 generally, light music is played. Some sideband interference from Radio France International is heard around 2000UTC on 11,995kHz.

NEW ZEALAND: RNZI Wellington's schedule up to October 2 is: 1650 - 1849 6100kHz Sunday - Thursday; 1850 - 2136 11,735kHz Sunday - Friday; 2137 - 0458 15,115kHz daily; 0459 - 0758 11,900kHz daily; 0759 - 1206 6035kHz daily; and 1207 - 1649 on 6035kHz occasional. 6035, 6100 and 11,900kHz are tentative frequencies.

There is a programme for shortwave listeners in which letters are answered and the writer provides the latest DX news. This is broadcast every second week on Monday at 0430, Thursday at 0830 and Friday 1930UTC.

SAIPAN: KHBI Monitor Radio Int has broadcasts to Oceania at 1800 on 9355kHz; 2100 on 13,840kHz; 2300 on 13,625kHz, 0800 on 13,615kHz; 1000 on 13,625kHz; 1100 and 1200 on 9425kHz. Each transmission is one hour duration. The transmitting site at Scotts Corner, Maine WCSN, has been sold to Prophecy Countdown and this will result in a new transmitter being installed at the other site of WSHB Cypress Creek, South Carolina in September. This will centralise the transmitting site of Monitor Radio Int.

USA: WRMI Radio Miami International, which has been under construction for some months with plans to broadcast into the Caribbean area — in particular Cuba — is installing a 50kW transmitter and has been assigned the frequency of 9955kHz. Jeff White advises that operations should have commenced by the time this is in print, and reports should be sent to Radio Miami International, 8500 SW 8 Street, Suite 252, Miami, Florida 33144 USA. ◆

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.

Construction Project:

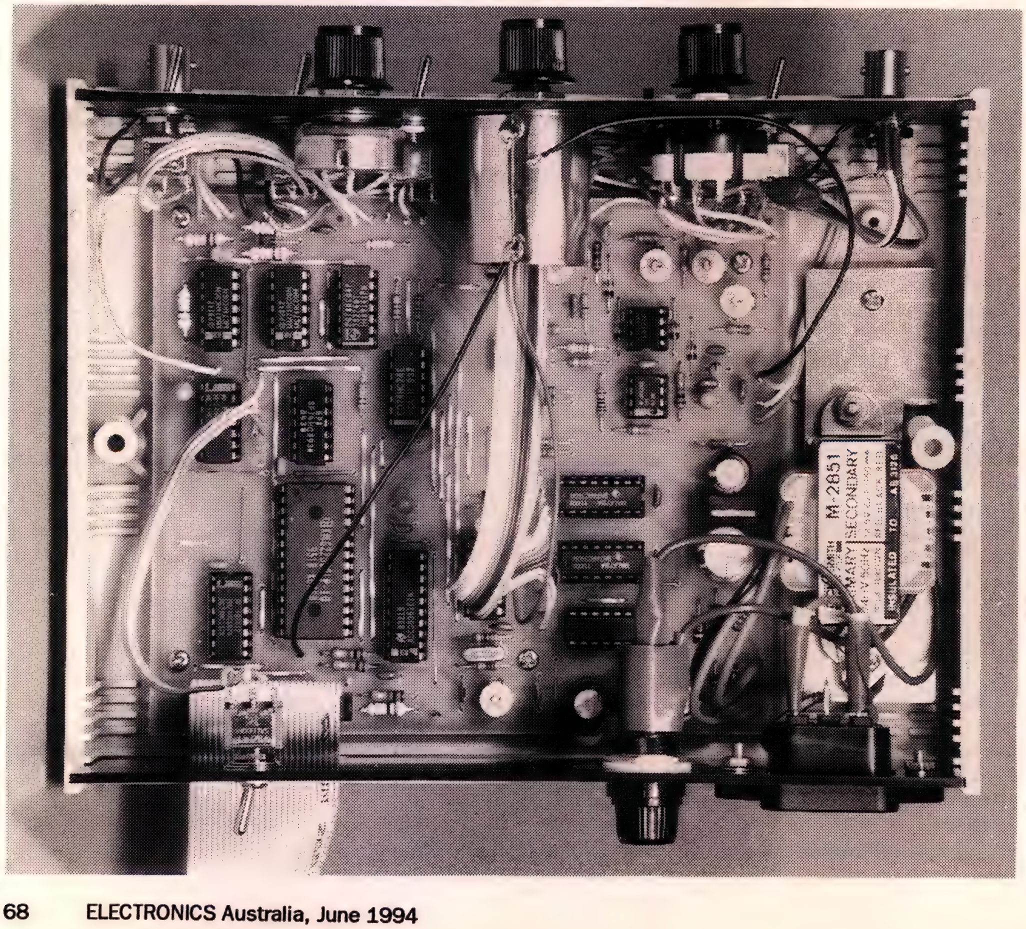
AN IMPROVED DSO ADAPTOR FOR PC'S - 2

As promised, here are the full construction details for our new PC-based DSO adaptor Mark 2. Also described are its testing and adjustment, including calibration and frequency compensation of the vertical amplifier. Using the adaptor in conjunction with the new and enhanced 'Version 3.0' software package from David Jones will be discussed in the third and final article.

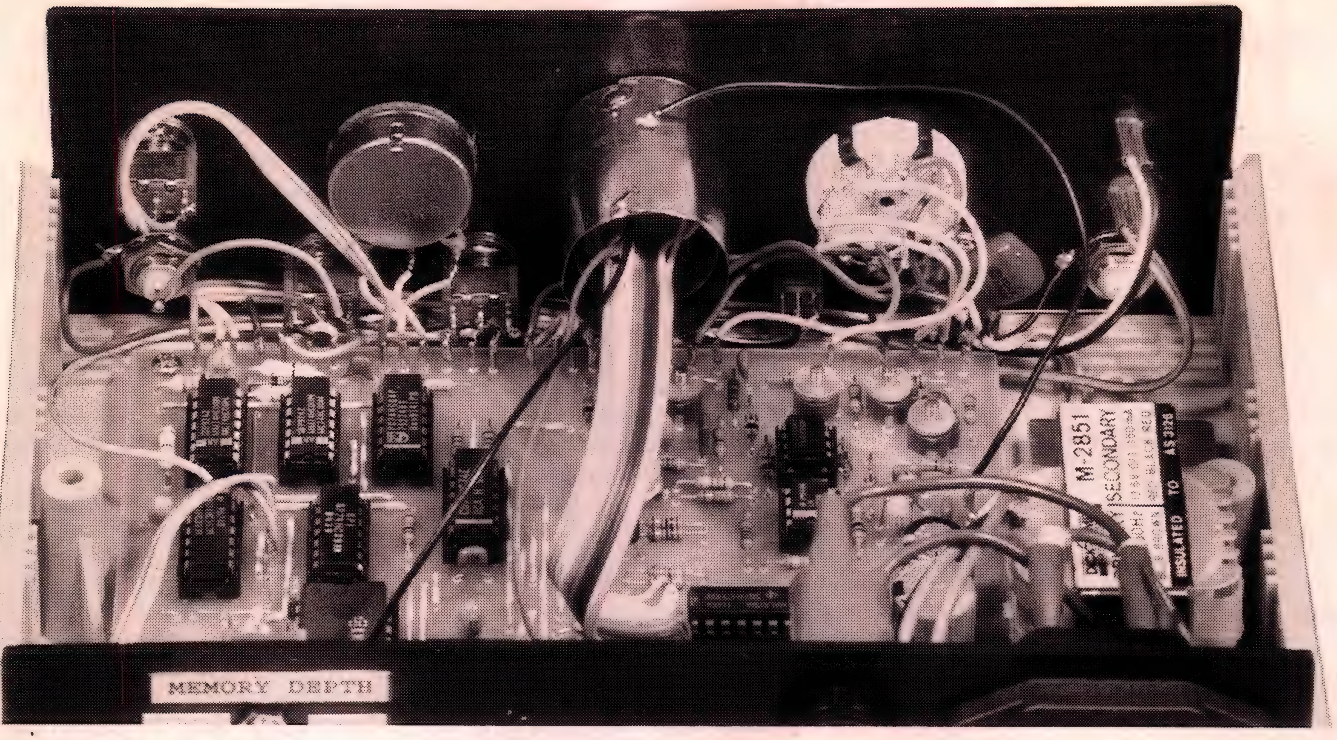
by JIM ROWE

As you're no doubt aware from the photographs, the new DSO Adaptor is housed in a low cost standard plastic instrument case, measuring 200 x 160 x 70mm (or 65mm). To simplify the construction most of the circuit components are mounted on a single PC board, measuring 143 x 123mm and coded 94dso5. The only parts not on the board are the input connectors and controls (all mounted on the front panel); the vertical input coupling capacitor C1; a couple of the input attenuator compensation capacitors (C32 and C33); power transformer T1, which mounts on a small earthed aluminium plate beside the PCB; the IEC mains input connector and mains fuseholder, which both mount on the rear panel; and the optional switches for manual read/write mode switching (S9) and effective memory depth — which also mount on the rear panel, if they're used. A memory depth switch is actually shown on the prototype's rear panel.

Because of the high input impedance of the vertical input circuitry, it tends to pick up noise and hum from both outside the adaptor's plastic case, and from the digital circuitry inside it. To minimise this pickup, a shielding plate made from an 80 x 45mm rectangle of unetched PCB laminate is fitted immediately underneath this area of the main PCB — a very successful technique pioneered by Rob Evans in his Noise and Distortion Meter design. Holes are drilled and reamed in the shield board so that it clears the mounting pillars for the main



Most of the components in the new DSO Adaptor are mounted on a single horizontal PC board, as you can see from this view looking directly into the case with the lid removed. The compact 2VA power transformer used mounts alongside the board on a small plate cut from one millimetre aluminium sheet. The ribbon cable which connects the adaptor to the parallel printer port of a PC enters via a slot in the rear panel, and plugs into connector J2 via 26-way IDC connector.



This view looking inside the case at the rear of the front panel should help you in wiring up your adaptor. Note the cylindrical tinplate shield around the time/sample switch S8, in the centre of the panel. The shield is connected via a length of insulated hookup wire to the PCB earth pin near C15, on the right hand side in this photo.

PCB, and the copper of the shield board is connected to the main PCB earth line.

A small cylindrical shield is also fitted around the body of the rotary timebase selector switch S8, to minimise coupling from the 5V p-p timebase signals present there. This shield is cut and formed from a 100 x 35mm strip of thin tinplate, and is again connected to the main PCB earth line.

The combination of the two shields reduces the noise induced into the vertical amplifier to a very low level.

Construction

As usual, the best way to start construction is to assemble all of the small components on the PC board. This should be fairly straightforward if you use the overlay diagram and the photos as a guide, and follow the steps I'll now give.

Assuming your board is drilled, and that you've checked it to make sure there are no faults in the etching, I suggest that you start by fitting all of the PCB terminal pins. There are 47 of these, most of them around the outside of the board — apart from the 11 located between ICs U3/U4/U7 and U6, which handle the timebase clock signals — plus up to five further optional pins between U13 and U14, if you wish to fit the optional EOB switching to adjust effective memory depth.

With the PCB pins fitted, the next step is to fit the links which run on the top of the board (one of the small prices we pay for using a single-sided PCB). There are 35 of these, plus an additional link for the EOB connection if you elect *not* to fit the optional memory depth switching. All of these links are straight and run either 'North-South' or 'East-West'. I suggest you use single-core insulated hookup wire to make the links, stretching it slightly so that they lie straight.

After the links, it's a good idea to fit the DIL connector strip J2 and the IC sockets. I recommend that you use sockets for all of the DIL devices, as apart from the two op-amps U5 and U8, the others are all CMOS devices and sockets allow you to leave fitting the actual chips until the end. If you *really* want to save money, you could skip the sockets for the lower cost chips, but at the very least you should fit sockets for the two expensive chips U12 (the A/D converter) and U16 (the SRAM).

Don't fit the two voltage regulator chips (U1, U2) or the reference device U11 at this stage. Instead, fit the passive components — first the resistors, next the small ceramic and monolithic capacitors, then the diodes and trimmer capacitors, and finally the tantalum and aluminium electrolytics, the calibration trimpot VR1 and the 2MHz crystal X1. Take special care not to overheat the relatively fragile monolithic caps during soldering, and also to place the polarised parts the correct way around. Watch also that you fit the 10-60pF trimcaps (brown plastic) in positions CV2 and CV3, and the 2-20pF trimcaps (green) in the other three positions.

If you now fit the two voltage regulator chips U1 and U2, and the reference chip U11, your PCB assembly will be complete apart from the DIL devices.

Note that if your reference chip is an LM4040CIZ-2.5V, you won't need to fit resistors R36 and R37 (both 10k). These resistors are only required if you use the alternative LM336Z-2.5 or LM4041CIZ-ADJ devices. It's perhaps also worth reminding you at this stage that if you have elected to use the cheaper but slower ADC8020 chip for U12, you should also have used a 680 ohm resistor for R21 instead of the 150 ohms needed for the faster ADC08061 chip.

Just before you continue, now is a good time to fit the small insulated link which goes *under* the PCB, from pin 10 of U6c to pin 15 of connector J2.

Front, rear panels

The next construction step is to prepare the front panel, by drilling and reaming the holes for the various controls and connectors. I suggest you use an accurate 100% photocopy of the front panel artwork as a template to mark the hole locations, so that everything lines up correctly, and also that you use the various controls and connectors themselves as 'gauges' when you ream the holes to size. This avoids ending up with holes that are too large...

If you are using the same plastic-body

rotary switches as used in the prototype, you may care to follow the technique I use, which involves drilling a small 'blind' hole in the rear of the plastic front panel, to mate with the locating spigot on each switch. This prevents the switch from rotating, without having to tighten the attachment nut to the point where you risk stripping the plastic thread moulded into the switch ferrule. I also like to drill a similar but smaller locating hole for the miniature toggle switches, to mate with their keyed spigot washers and ensure that *they* don't rotate either.

With the single-hole mounting BNC sockets, I even like to file these to shape with a small round file, to get an elongated 'flat sided' hole which will just accept the socket ferrule with its milled flats. This again prevents the sockets from working loose and rotating in use — without the need for over-tightening the nuts.

When mounting the indicator LEDs, you have a choice. You can of course use the moulded clip-together ferrules for these, if you like them. Personally I find them a bit ugly, and I prefer to simply drill and ream the panel holes very carefully, until the LEDs just fit in them snugly from the rear. Then when the rest of the holes have been finalised, and the stick-on Dynamark metal dress panel applied carefully to the front, I push the LEDs through the holes from the rear, as far as they'll go comfortably, and apply a small fillet of plastic adhesive around them at the rear. The panel is then put aside for 24 hours, for the adhesive to set. Note that the green LED is used for the lower 'Sampling' indicator, and the red one for the 'A/D OVF' indicator.

Before finally mounting the rotary switches and pots, I like to cut their shafts to a suitable length (say 10mm) to mount the knobs, and if necessary also file flats on them carefully to locate the knob attachment screws. This again makes it unnecessary to over-tighten the screws.

The final stage of assembling the front panel is to fit all of the controls and connectors, and fit the knobs. It should then be ready for the wiring, a little later.

The rear panel is somewhat simpler than the front panel, and therefore a little easier to prepare. The main tasks are to cut the mounting holes for the IEC mains connector and fuseholder, and also the rectangular slot in the lower edge, near the far end, to clear the ribbon cable when it exits from J2. The location and dimensions of these holes are shown in the small diagram.

If you wish to fit the optional manual Write/Read mode switch S9, and/or a switch to adjust the DSO's effective memory depth, holes for mounting these on the rear panel will also need to be made. The logical position for them is above the slot for the ribbon cable, as shown in the rear view photo last month.

Once the holes have been prepared in the rear panel, the IEC connector, fuseholder and optional switches can be mounted on it, and your rear panel is now also ready for the wiring stage.

The final preparation step is to make the transformer mounting plate, and the two shields. As mentioned earlier, the transformer plate is cut from 1mm aluminium sheet, and measures 100 x 30mm. It has a small notch cut in one side, as shown in the diagram, to clear the assembly spigot at the end of the case lower half. Otherwise there are five 3mm-diameter holes which have to be drilled: two to mount the transformer on the plate, to more to mount the plate in the case, and the final one to attach a solder lug for plate/transformer earthing.

The two transformer mounting holes (marked 'T') and the earthing screw hole ('E') are countersunk on the underside of the plate, to allow countersink-head screws to be used to mount both the transformer and the earthing to the plate. This leaves the lower surface of the plate flush, so that the plate can easily be mounted into the lower half of the case after the screws are fitted.

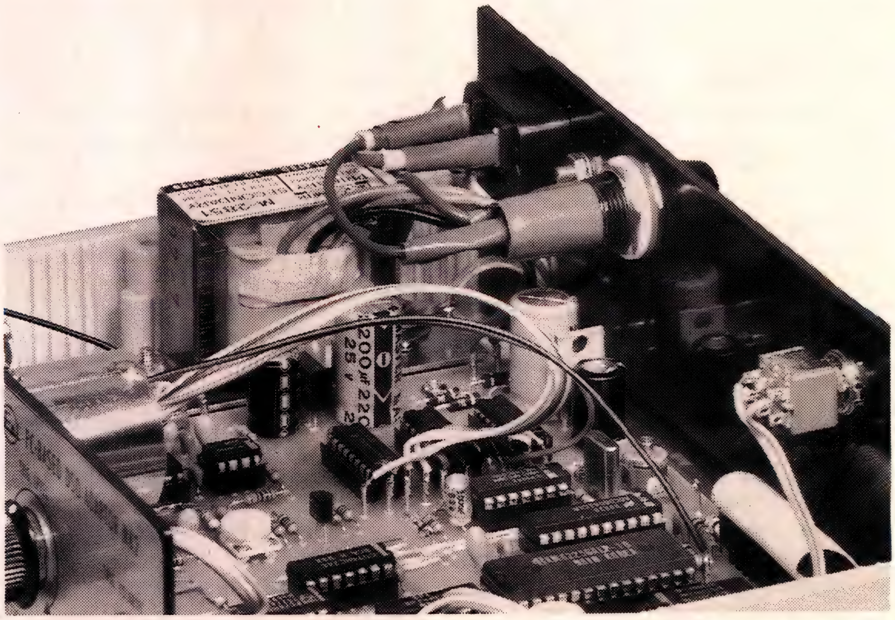
Note that 'star' lockwashers should be used under the nuts of each of these countersink-head screws, to ensure that neither the transformer nor the earthing lug works loose.

Since things are a little tight on the plate, the assembly procedure is to first fit the T and E screws to the plate, with the solder lug under the nut and star washer of screw E. All three screws are then well tightened, and the plate mounted in the case using self-tapping screws through holes 'M'. Finally the transformer is fitted to the plate, using further flat washers, star washers and nuts on the T screws.

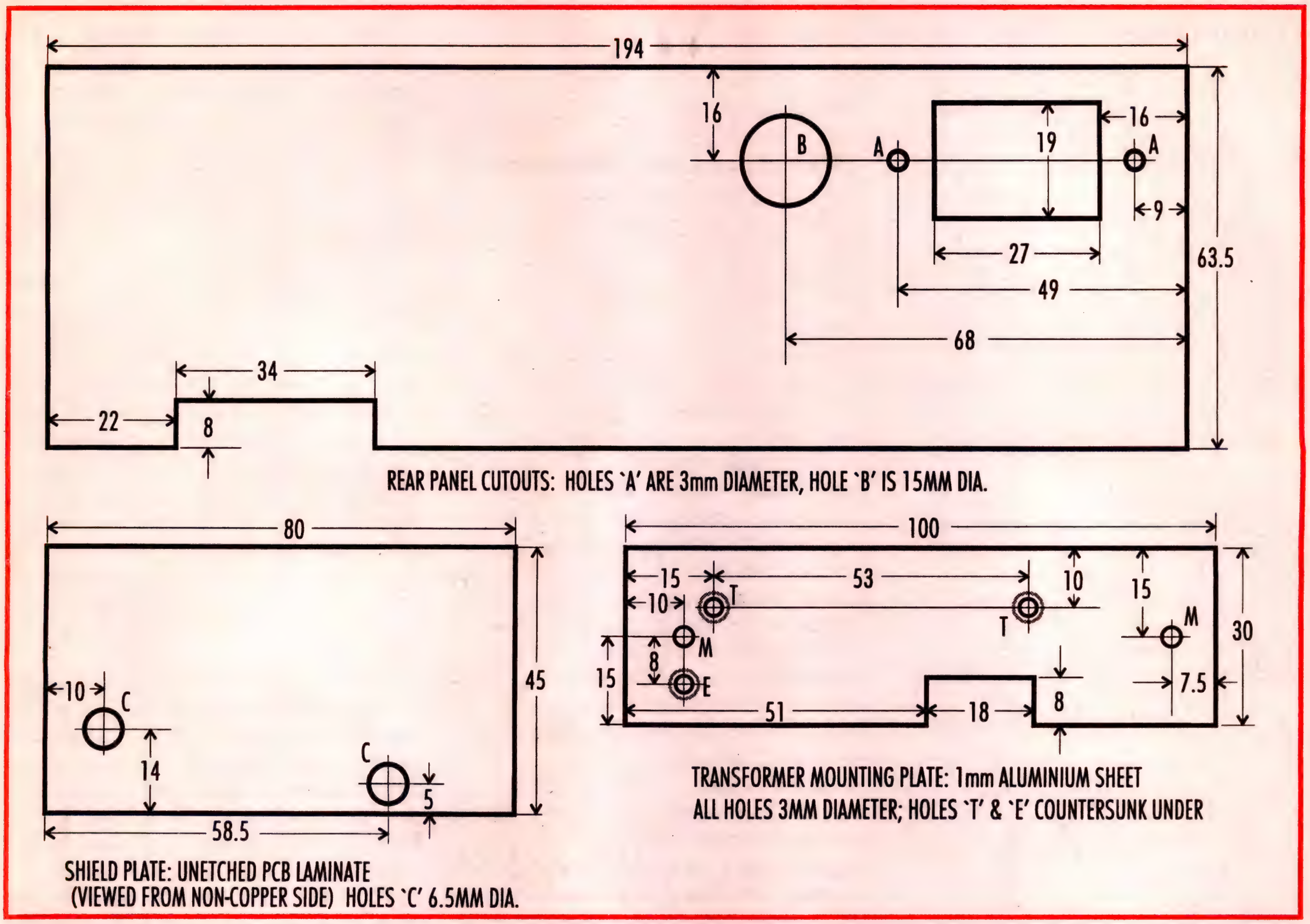
The shield plate for the vertical input circuitry at the front left-hand corner of the main PCB is cut from unetched PCB laminate (single sided), and measures 80 x 45mm. It has two holes 'C' about 6.5mm in diameter, to clear the mounting pillars for the main PCB (see diagram).

This shield plate is attached to the underside of the main PCB, as close as the solder joints of the latter will allow, but with its own copper side facing away from it (so it doesn't cause shorts!). The easiest way to attach it is by soldering three short lengths of tinned copper wire (i.e., component pigtail offcuts) to the earthy outer copper track of the main PCB — just near the corner, about 38mm up the side (near C7) and about 75mm along the front. These all face outwards, at roughly 90° to the board edges.

The shield plate can then be offered up



Another view inside the DSO Adaptor case, this time looking towards the rear and the mains input circuitry. Note the sleeving around the mains fuseholder and IEC input connector, to prevent accidental shocks.


194
16
B
A
19
16
A
9
27
49
68
63.5
34
22
8
REAR PANEL CUTOUTS: HOLES 'A' ARE 3mm DIAMETER, HOLE 'B' IS 15MM DIA.
80
10
C
45
14
C
5
58.5
SHIELD PLATE: UNETCHED PCB LAMINATE
(VIEWED FROM NON-COPPER SIDE) HOLES 'C' 6.5MM DIA.
100
15
53
10
15
10
T
T
M
M
30
15
8
E
51
18
8
7.5
TRANSFORMER MOUNTING PLATE: 1mm ALUMINIUM SHEET
ALL HOLES 3MM DIAMETER; HOLES 'T' & 'E' COUNTERSUNK UNDER

This diagram gives the dimensions for the holes to be cut out of the rear panel (top), plus the dimensions and hole details for the shield plate which goes under the vertical amplifier section of the main PCB (lower left!), and the transformer mounting plate (lower right).

underneath, and the three wires bent around and soldered to the exposed copper. The three wires not only hold the shield in place, but also ensure that it's properly connected to board earth.

(**Note, however:** The main earth track along the front of the main PCB has a deliberate 'gap', to minimise interference to the analog front end circuitry from circulating currents associated with the digital circuitry.

When you fit the third shield wire to the main PCB, near this gap, make sure that you solder it to the 'analog' side of the gap — i.e., the side nearer R8 and D5, NOT the side near R28. Otherwise, the shield plate will 'bridge' the gap and you may get noise in your vertical amplifier.)

Once the shield plate is attached to the main board, the two are ready to be mounted into the lower half of the case alongside the transformer plate, again using small self-tapping screws. However you will almost certainly have to clip off some of the unused mounting pillars moulded into the case, to clear both the shield plate and the solder joints on the underside of the main PCB, before they'll lie flat for mounting. Just make sure that you don't clip off any of the six pillars which *are* used for mounting! (Use the 3mm holes in the main PCB to locate these first, and perhaps mark them with a felt pen to prevent mistakes.)

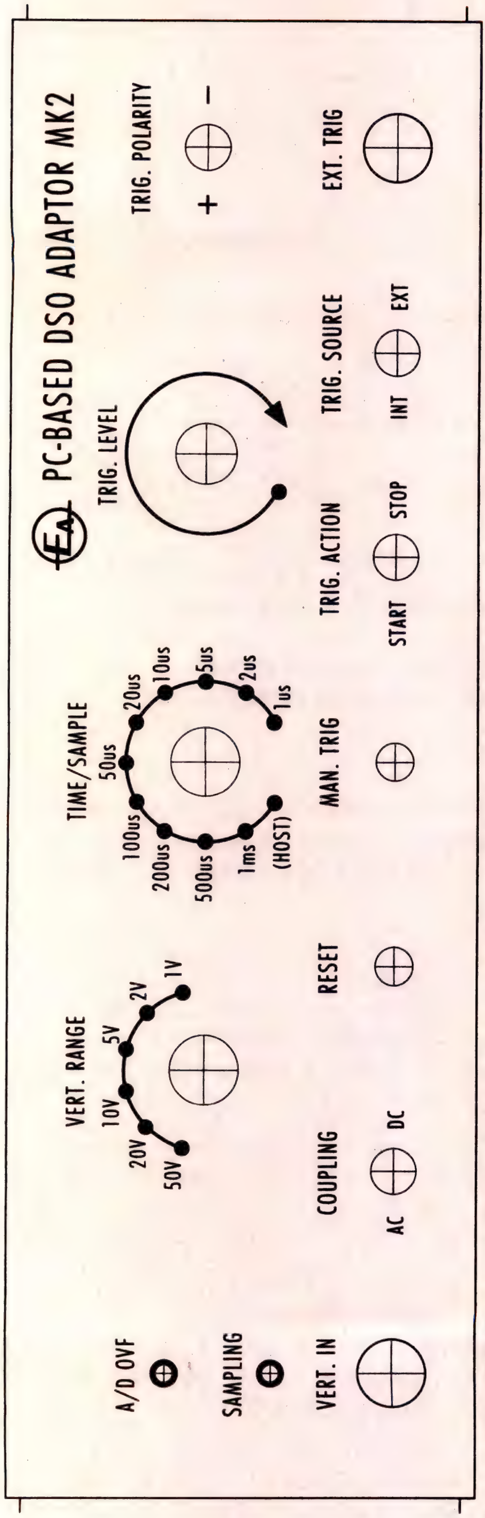
You can leave fitting the timebase switch with its small cylindrical shield for a while, at this stage — it's best left until you've soldered the leads to its lugs. However now would be the time to prepare the shield, from a 100 x 35mm strip of clean tinplate (which can be quite thin). Carefully roll it up around a piece of broomstick or a similar makeshift mandrel, until it becomes a neat springy cylinder about 24 - 25mm in diameter and 35mm long. Then it can be put aside briefly.

You're now ready to connect up the front panel controls and connectors, to both each other and the main PCB. Note that input coupling capacitor C1 mounts on the rear of AC/DC coupling switch S1, as part of these connections. Most of the connections to the main PCB connect to the pins along the front, and all are fairly easy to make if you lay the front panel face down, along the front of the case and PCB assembly.

The connections to the timebase switch S8 are the main exception, as these need to go to the pins up near U6, towards the rear of the board, and also to the pin marked 'S8h' near connector J2. Here the best plan is to prepare a length of 'rainbow' ribbon cable, about 130mm long and 12 conductors wide, by stripping back and tinning both ends of each conductor. Then solder the conductors to the switch, making a record of the colours used for each connection.

With this done, you can now slip the tinplate shield over the free end of the ribbon cable, and carefully slide it down over the body of the switch, so it reaches the rear of the front panel. A couple of 'tacking' solder joints can then be applied to the exposed overlap join, to hold it in place.

Once the shield is fitted, you can then run a length of insulated hookup wire from the earth pin on the main board, near C7 and R2, to connect the shield to



This artwork for the DSO Adaptor's front panel is reproduced here actual size, so that you can use it (or a copy) as a template for drilling the holes — and possibly as a dress panel.

analog signal earth. Then the free ends of the ribbon cable from the timebase switch can be soldered to the pins near the rear of the main PCB.

After you've wired input range switch S2 to the PCB pins, don't forget to add compensating capacitors C32, C33 and C34. The first two of these are fitted directly between the lugs on the switch itself, while C34 is fitted between the '50' and 'E' pins on the front of the PCB. All of these capacitors should have their leads trimmed as short as possible.

You should now be able to complete the mains wiring, which although straightforward should be done with care to ensure it doesn't present a safety risk. The first thing to do is run a length of mains insulated (green/yellow) wire between the 'E' pin of the IEC connector and the solder lug on the transformer mounting plate. Make sure the solder joints at each end of this wire are well made — one day your life could possibly depend upon them.

Note that *none* of the rest of the DSO circuitry is connected to this mains (safety) earth; it's purely to protect against shorts between the transformer primary and frame. Do not connect the PCB earth to it, as this can cause 'earth loop' problems when you are using the DSO Adaptor for measurements.

Next come the 'live' mains connections, and the main thing to watch here is that after soldering, each join must be fully sheathed in insulation using varnished cambric or heat-shrink plastic sleeving. So cut lengths of sleeving, and slip them over the wires before each joint is made, so they can be slid over the joint afterwards.

One primary wire from the transformer (the one with blue insulation) runs to the neutral ('N') lug of the IEC connector, while the other (brown) runs to the *side* lug of the fuseholder (NOT the end lug). Both of these wires will initially be too long, and will have to be cut to just a little longer than is needed once the rear panel is mounted in the case. With the excess cut from the brown lead, you'll probably have enough of this wire to make the remaining connection — which runs from the active ('A') lug of the IEC connector to the *end* lug of the fuseholder.

(Why have I emphasised the particular fuseholder lugs to use? Because if you wire the fuseholder the wrong way around, it's possible to get a shock from the fuseholder when the cap is unscrewed to change the fuse cartridge.)

With the transformer primary wiring finished, you can connect the secondary winding to the three adjacent pins on the PCB (near D11). The two outer wires connect to the outer pins, and the centre-tap pin to the centre pin. Don't leave the leads at their full original length, though; cut off the excess so they're only a little longer than is needed.

The wiring of your DSO should now be almost complete. All that may remain is the wiring to the optional Write/Read switch S9, and/or the memory depth switch. If you fit S9, it's simply connected to the PCB pin between R34 and J2, and the pin marked 'E' between R22 and C10, at the back edge of the board. Wire it so that these pins are shorted together in the 'Read' position, and left disconnected in the 'Write' position. (Note that with the latest version of David Jones' software, the switch is not needed; if you do fit it, you'll have to leave it in the 'Write' position.)

If you decide to fit a memory depth switch, it's connected to the pins on the main PCB between U13 and U14 instead of the centre short link. The rotor of the switch connects to the pin nearest U18 and the front of the board, while the other connections run to as many of the other pins as you wish to select from.

The simplest approach, used on the prototype, is to use an SPDT toggle switch and select between the first of the remaining pins ('32K') and the next one ('4K'), giving a choice of either 32K or 4K bytes of effective memory depth.

To essentially complete the DSO Adaptor construction, all you have to do is make up the ribbon cable which connects it to the PC's parallel printer port. This uses a 2m length of 25-way ribbon cable, with IDC connectors crimped on it at each end — a 26-way DIL header at the adaptor end, to mate with J2, and a DB-25 plug at the other. Needless to say the connectors are fitted so that pin one of each connects to the end conductor on the same side of the ribbon (so pin 26 of J2 will be left unconnected).

Checkout & adjustment

Your adaptor should now be complete, except for adding the DIL ICs. This will allow you to connect the power, and carefully check that the power supply circuitry is operating correctly before these ICs are added.

If you have a DMM handy, you should be able to measure +5V at the short link adjacent to C12 (between U3 and electrolytic C2), relative to the board earth, and -5V on the lead of diode D3 nearest to capacitor C5 (between trimcaps CV3 and CV4). You should also be able to measure +2.5V at the 'top' lug (clockwise end) of trigger level pot VR2.

If these voltages are correct, your power supply is functioning correctly and you can switch off, unplug the power lead and carefully fit all of the DIL ICs to their respective sockets — making sure you orientate them all correctly using the overlay diagram as a guide.

Hopefully you're now ready for checkout and adjustment, although you might like to apply the power again and use your DMM to check one more voltage — that at the centre lug of trimpot VR1. This should measure very close to +1.25V with respect to board earth, when the input coupling switch S1 is in the 'AC' position, and within a millivolt or two of earth when the switch is in the 'DC' position. If these voltages are reversed, you've wired the 'B' side of the switch wrongly!

The easiest way to complete the adaptor's testing and adjustment is to connect it up to the PC, and fire up David Jones' software. Then you'll be able to monitor things via the screen display.

First of all, set the DSOA's vertical range switch to the 1V position, the timebase switch to the 100us position and the trigger level pot to mid-range. Also set the input coupling switch to AC, the trigger action switch to Start, the trigger source switch to Internal and the trigger polarity switch to '+'. If possible, the memory depth should also be set for say 4K, as this will make things faster. If you have an optional Write/Read switch (S9), it should be set for Write mode. Finally, the internal calibration trimpot VR1 should be turned to its fully *anticlockwise* position.

Then connect the vertical input to an audio generator, which is set to produce a sinewave at around 50Hz and with its output level carefully set to an accurate 1V p-p. (You can check this with your DMM, set to AC volts; it should read as close as possible to 353.6mV RMS.)

Try pressing the Reset button on the DSOA front panel. The green 'Sampling' LED should light briefly (about half a second, for 4K memory depth), and then go out. The red 'A/D OVF' LED should not light. If all is well, your DSOA is probably sampling correctly.

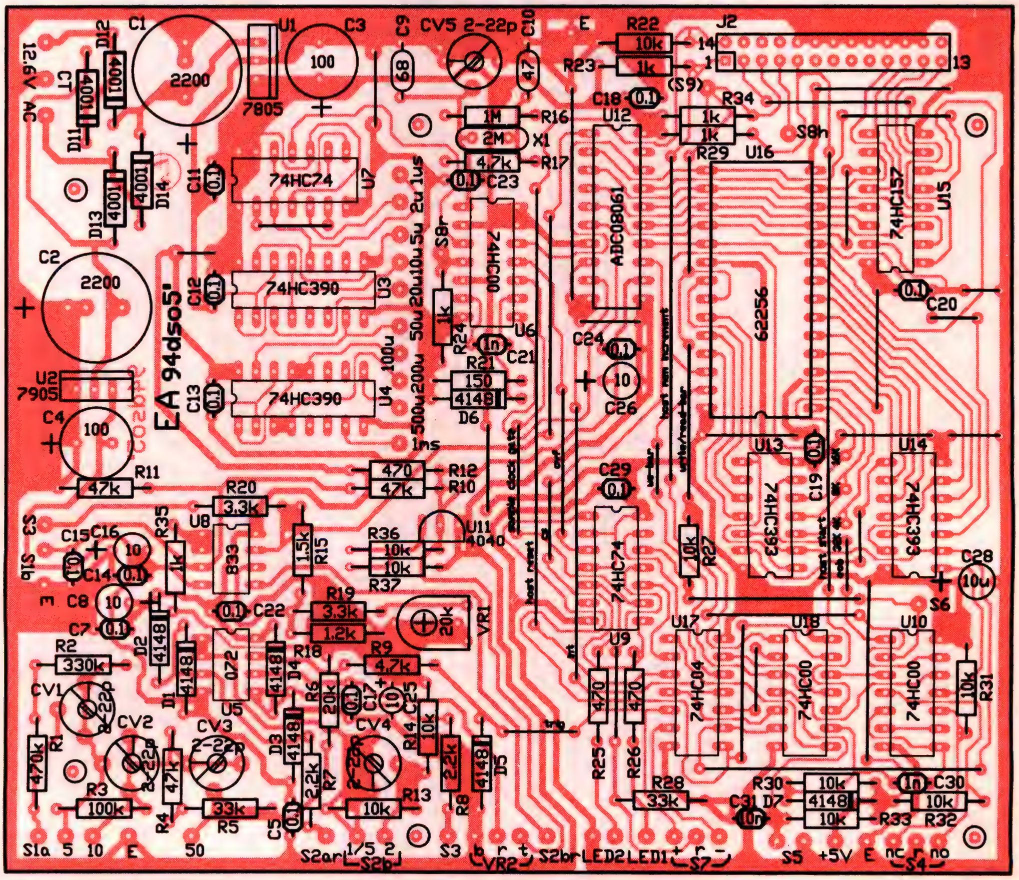
Now run the Tronnort DSOA Version 3.0 software, and set it to look for the adaptor on the printer port you've connected it to. You should also set it to the 1V vertical range; the 100us per sample timebase range; 500 samples displayed; for Start trigger mode; for DSOA triggering (as opposed to software triggering); for Graticule On; and for the Buffer memory size (depth) your DSOA is set for.

If you try pressing the <O> (one shot) key, the 'Sampling' LED on the DSOA should again glow for a short time, and then a second or two later a waveform should appear on the screen. You should see about two and a half cycles of sinewave, and its amplitude should be a little less than the full graticule height.

Vertical calibration

Assuming all is well so far, you're ready to adjust the DSOA's basic vertical calibration. By pressing the <U> key on the PC keyboard, you should get a continuous sequence of sampling sequences and updating of the screen display. This will allow you to carefully adjust the calibrate trimpot of the DSOA, with a small screwdriver, until the displayed waveform on the PC screen *almost* (but not quite) reaches the full height of the graticule.

If you turn the trimpot too far, the red 'A/D OVF' overflow LED on the DSOA front panel will start flashing along with the sampling LED, and the displayed waveform will distort due to converter overload — so back off until this stops. The correct setting of the trimpot is where the known 1V p-p waveform is as close as possible to the full graticule height, without the red LED flashing.



Use this overlay diagram as a guide, along with the internal photographs, when you're fitting the components to your own PC board. Note that there are quite a few wire links which must be fitted to the top of the board. The small vertical link between U13 and U14 marked 'EOB' is replaced by wiring to the optional memory depth switch, if used. In this case PCB pins are fitted to the holes at either end of the link as shown here, along with the holes just above marked '4K', '8K', and '16K'. A small insulated link must also be fitted under the PCB, between pin 10 of U6c and pin 15 of connector J2.

Improved DSO adaptor for PC's - 2

With this done, the basic voltage calibration is completed, and you're ready to adjust the input attenuator compensation. So press the <ESC> key on the PC keyboard, to exit the continuous update mode, and prepare for this as follows.

First, change the audio generator's output frequency to 10kHz, and set it to produce a square wave of about 700mV p-p. (If you have a pulse generator with a better squarewave output, this would be preferable.) Then change the DSOA timebase switch to its fastest 1us range, and select the corresponding range on the DSOA software screen. Also set the software to display 200 samples, which will correspond to two signal cycles at 10kHz (200us).

Now press the <U> key on the PC keyboard again, and you should again see a repeatedly updated display of the waveform. Since your DSOA should still be set to the 1V range, you should see a couple of cycles of square wave, with an amplitude about 70% of the graticule height. The exact waveshape will depend largely on the output from your generator.

Now try turning the DSOA's range switch to the 2V range. The waveform will drop to half its original amplitude, and its leading edges will probably develop either overshoot (spiking) or undershoot (rounding).

By taking a small insulated alignment tool (or knitting needle filed to a screwdriver blade), you should be able to adjust trimcap CV4 to correct this distortion, and restore the waveform to a clean square wave.

Some TL072 op-amps may introduce a small amount of ringing to the square wave, which cannot be removed using CV4. If this seems to be your situation, try adding a 10pF or 12pF capacitor from the 'S2b-2' pin of the PCB to ground (i.e., effectively across R14). This will usually remove the ringing, and allow optimising the compensation.

Now turn range switch S2 to the 5V position, and increase the square wave output from the generator until you get a display of reasonable height again. The waveform will probably again be distorted, with either overshoot or undershoot. This time, it should be correctable (or nearly so) by adjusting trimcap CV1.

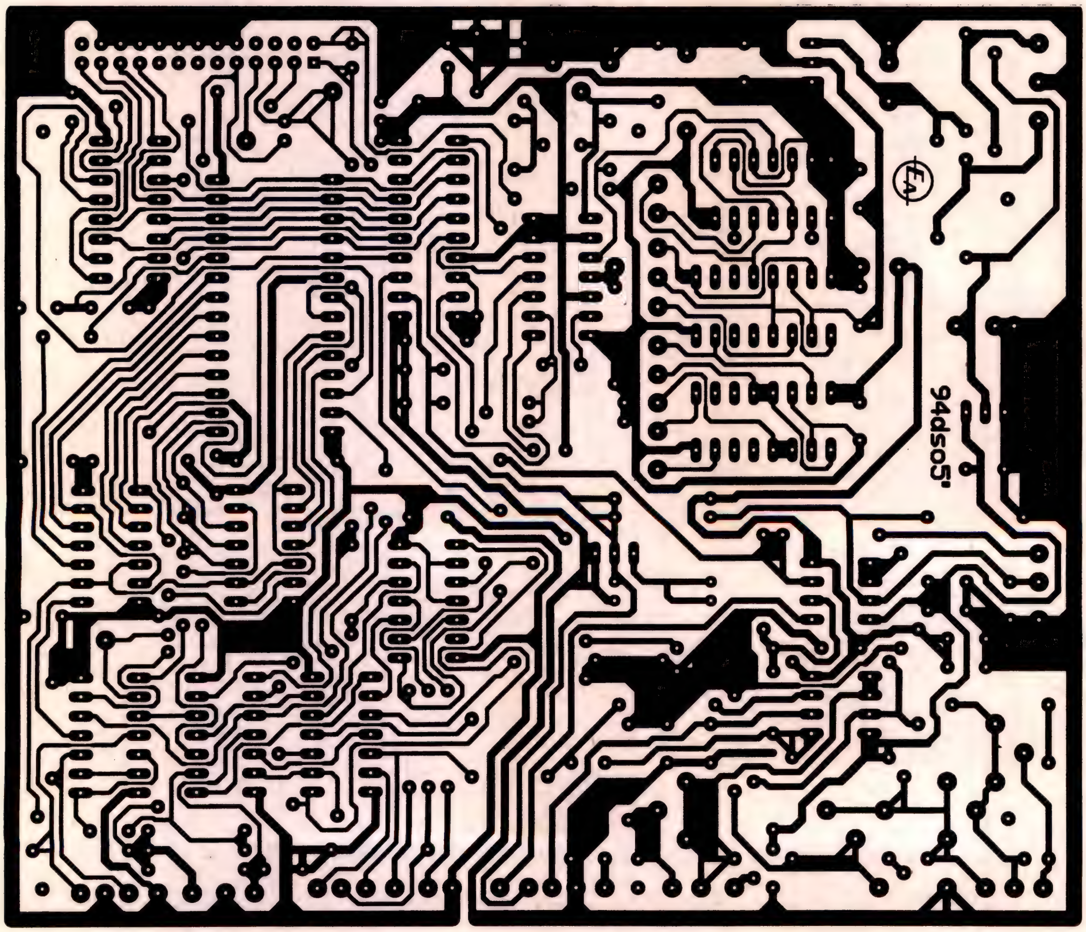
With this done, turn S2 to the 10V range, and again adjust the generator output if necessary to get a reasonable display height. To correct any distortion this time, the trimcap to adjust is CV2.

After this, turn S2 to the *lowest* 50V range (NOTE: not the 20V range, which has already been set along with the 2V range), and repeat the procedure again — but now using trimcap CV3.

Note this relationship between the various trimcaps and the ranges they are used to achieve the correct compensation for: CV4 is for the 2V and 20V ranges, CV1 for the 5V range, CV2 for the 10V range and CV3 for the 50V range. And that's also the order that these initial adjustments should be made in.

However with the exception of the CV4 setting, these trimcap adjustments are all interactive; adjusting one tends to affect the others. As a result, you actually need to run through the CV1/2/3 adjustment sequence again a couple of times, to 'fine tune' them and make sure that the overall compensation is optimised. Once this is done, though, your DSO Adaptor is effectively finished and ready for use. All that remains is to add the top half of the case, and fit the two large screws which hold it together.

In the third and final article, we'll discuss using the Adaptor in conjunction with David Jones' enhanced software. ❖



Here's the artwork for the DSO Adaptor PCB, reproduced here actual size as usual, for those who wish to etch their own board. The deliberate break in the earth track near the centre at the bottom, is to ensure that circulating currents do not inject digital noise into the vertical amplifier input circuitry.

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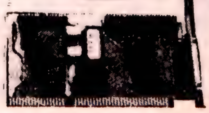

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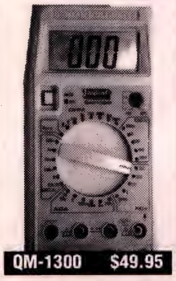

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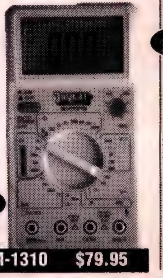

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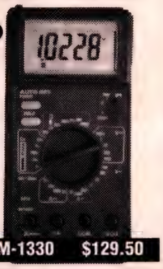

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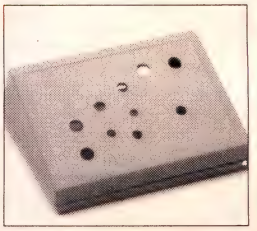

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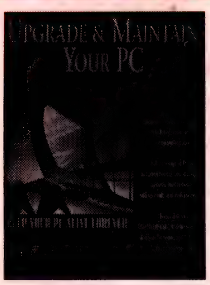

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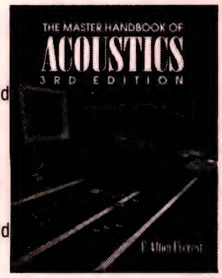

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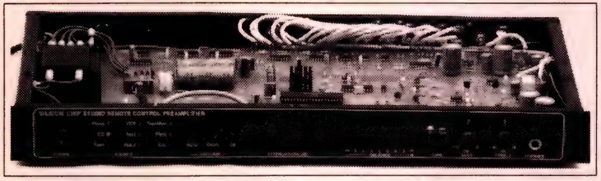
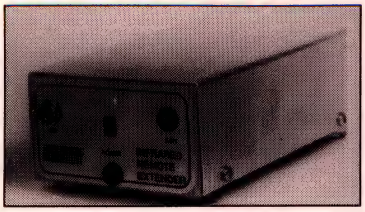


REF S.C. SEPT/OCT/NOV 1993 - This brilliant Blue Print Kit includes: •Low noise radiation torroid power transformer •Fully punched and screened front panel in distinctive "Blueprint" artwork •Gold plated RCA Sockets throughout •Special low capacitance screened cabling •Machined pin IC sockets for the microprocessor •1% resistors instead of carbon types •Pre programmed microprocessor included in the cost •Pre wound chokes •Metal thread fixing screws, fixing inserts clinched into chassis •Beware of cheap chassis that use self tapping screws •Specially written step by step instructions •Remote control extra. For full specifications see our 1994 catalogue

Cat. KC-5142 **$449.00**

Pre-programmed remote control **Cat. KC-5141** **$89.95**

Remote Control Extender Kit For VCR's



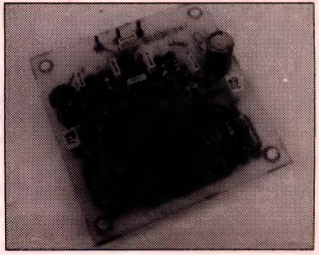
Ref: Silicon Chip April 1994.

Many homes now have a second TV set, either in the bedroom or kitchen. Whilst its quite easy to connect the second set to the VCR (usually located in the living room) controlling the VCR from a remote location is another story altogether. This kit solves that problem by relaying the remote control signal transmitted from the second location, down figure 8 flex, to the VCR in the living room. It is also ideal for operating your Hi Fi if you have a remote speaker set-up. Kit is supplied with instrument case, 10 metres of cable, IR LED's, PCB, labels, plus all specified components. Plug pack extra - use MP-3007 $15.95.

Cat. KC-5158 **$49.95**

NEW KITS - NEW KITS - NEW KITS

Low Noise Universal Stereo Preamp Kit

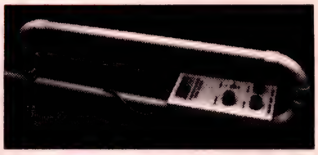


Ref: Silicon Chip April 1994.

Based around the popular LM833 dual op-amp IC, this preamp is designed for use with a magnetic cartridge; cassette deck or dynamic microphone. The performance of the design is far better than most preamps in many stereo amplifiers, making it a worthy replacement if your current preamp falls short of expectation. Kit is supplied with components to make either a RIAA/IEC based preamp, cassette deck preamp or mic preamp plus PCB and standoff supports.

Cat. KC-5159 **$14.95**

Induction Balance Metal Detector Kit

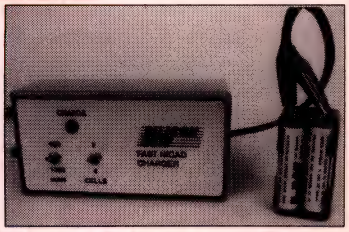


Ref: Silicon Chip May 1994.

This metal detector kit is a cinch to put together and is suitable for use over wet or dry ground, including beach sand. Audible indication of detection is via a headphone or loudspeaker output, and increases in frequency as metal moves under the search head. Operation is straight forward with only three controls: volume, ground (to adjust loudspeaker frequency when the search head is positioned over the ground) and sensitivity. the Jaycar kit is supplied semi-short form ie: case, PCB, all specified electronic components and copper wire to wind the search head. Conduit avaialable from hardware stores. Plates for search head are available from K-Mart.

Cat. KC-5161 **$59.50**

Fast Charger Kit For Nicad Batteries

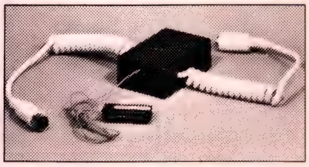


Ref: Silicon Chip May 1994.

Nicads can make running battery operated gear much cheaper than using dry cells, but they do have one disadvantage - when the batteries go flat it usually takes about 16 hours to recharge them. This charger solves this by charging either two or four AA, C or D cells in rapid time - 50 minutes for AA 600mA cells, and 100 minutes for C and D 1.2Ah cells. The kit features auto cut-out when the batteries are fully charged, a timer overide plus fast and trickle charge selection. it is also powered by 12VDC making it ideal for car or home. The Jaycar kit is suppliec with PCB, cas. label plus all specified components. For use at home, use our 12VDC 1 amp plugpack MP3015.

Cat. KC-5160 **$49.50**

Screen Saver Kit For PC's



Ref: EA June 1994.

It's a well known fact that leaving the same picture on a monitor for extended periods of time can "burn" the image onto the phosphor coating on the inside of the picture screen. This kit solves this problem by turning off the picture to the monitor when the keyboard hasn't been touched for a preset time period. To turn it back on simply press any keyboard button. The unit can be programmed via wire links to time for any period from a few seconds to many hours of non keyboard activity before the screen blanks out.

Kit is supplied short form so that the PCB can be mounted inside. Kit includes PCB, 26 way IDC card edge connector (to connect to a VGA card) plus all electronic components.

Cat. KA-1762 **$14.95**

James Bond Gone Wrong!!!

THE PATENTED BUGGING DETECTOR THAT NEVER SOLD.

We get some strange surplus stock offers but this was one of the strangest. About a year ago we were offered this product, the supplier however would not accept our cash offer. Well they came back and finally accepted.

The product was designed to sweep telephone and power lines to see if they were bugged. The gadget itself looks awfully impressive but we would say that it would take a fair bit of skill to actually get it to do its original job (as far as we know they are in working order). We are not selling them as operational bugging detectors however. We offer them to you for the goodies inside!!

Firstly the unit is housed in a grey ABS slope front cabinet measuring 173 x 148 x 70mm. On the front panel are 6 x 15mm quality collet fixing knobs and 1 x 35mm collet fixing knob. Such knobs are generally seen on the most professional equipment. Inside double-sided foam taped to the cover are two, yes two 9 volt nicads. They have not done any work. There is also a circuit board holding lots of recoverable parts as well. The price of a 9 volt nicad is $16.95 - you get two here. The knobs are worth about $18, the case about $5 - never mind the other bits. All that we are asking for this is $19.95 - another great Jaycar surplus buy!

Cat. YB-4000 **$19.95**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

COMPUTER LEADS

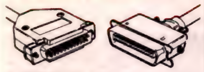
Don't Miss Out On These Specials

Quality Disks At Silly Prices Slashed!!!

•LIFETIME WARRANTY ON THESE DISKS

5.25"	DSDD	**Cat: XC-4730**	**$4.50 Pkt 10**	
5.25"	DSHD	**Cat: XC-4732**	**$7.95 Pkt 10**	Was $8.50
5.25"	DSHD-F	**Cat: XC-4733**	**$9.50 Pkt 10**	Was $9.95
3.5"	DSDD	**Cat: XC-4736**	**$7.95 Pkt 10**	Was $8.50
3.5"	DSHD	**Cat: XC-4738**	**$10.50 Pkt 10**	Was $12.95
3.5"	DSHD-F	**Cat: XC-4739**	**$12.50 Pkt 10**	Was $14.95

Standard Printer Lead



2 METRES LONG
D25 male to Centronics.
Cat. PL-0854
Normally $12.95
Now $7.95
SAVE $5.00

Standard Printer Lead

5 METRES LONG
D25 male to Centronics.
Cat. PL-0932
Normally $15.95
Now $9.95
SAVE $6.00

D25 Serial Cable

2 METRES LONG
D25 male to D25 male.
Cat. PL-0856
Normally $11.95
Now $7.95
SAVE $4.00

Serial Ext Cable

2 METRES LONG
D25 male to D25 female.
Cat. PL-0855
Normally $
Now $9.95
SAVE $5.00

9 Pin Extension Cable

2 METRES LONG
D9 male to D9 female.
Cat. PL-0871
Normally $12.95
Now $7.95
SAVE $5.00

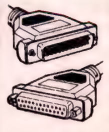
VGA Extension Cable

2 METRES LONG
Hi-den. D15 male to female.
Cat. PL-0873
Normally $14.95
Now $9.95
SAVE $5.00

Keyboard Ext Cable

2 METRES LONG
5 pin DIN plug to 5 pin DIN socket.
Cat. PL-0874
Normally $9.95
Now $6.95
SAVE $3.00

Null Modem Cable

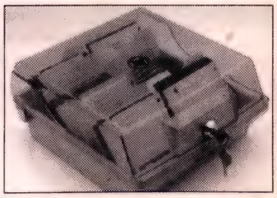


NEW

2 M LONG
The RS232 Null Modem cable is used to link two computers via a serial port to make easy back-ups etc.
Cat. PL-0858 **Now $14.95**

3.5" Floppy Diskette Storage Box

NEW



This high impact plastic storage box will keep your disks safe and free from dust, dirt etc. Holds "100" disks and has a lockable (2 keys supplied) clear perspex lid for added security. Comes complete with plastic file dividers.

Cat. XC-4690 **Don't pay $12.95 - Jaycars price $9.95**

Price Breakthrough On Deluxe Rack Cabinets

"WE HAVE CHANGED SUPPLIERS AND HAVE BEEN ABLE TO LOWER OUR PRICES."

These beautifully crafted rack cabinets will give your equipment a first class appearance. They have steel sides, back, top & bottom each with natural or black finish 3mm thick front panel. Top & bottom panels are ventilated & easily removed. The 88mm &132mm units are supplied with handles. They come complete in flat pack form & are easily assembled in a few minutes. Mounting hole centres conform exactly to International IEC specs both vertically and horizontally. For full specifications see our 1994 catalogue on page 71.

NEW

1 unit	**44mm**	**Black**	**HB-5410**	**was $79.95**	**now $69.95**
1 unit	**44mm**	**Natural**	**HB-5411**	**was $79.95**	**now $69.95**
2 unit	**88mm**	**Black**	**HB-5412**	**was $97.50**	**now $84.95**
2 unit	**88mm**	**Natural**	**HB-5413**	**was $94.50**	**now $84.95**
3 unit	**132mm**	**Black**	**HB-5414**	**was $105.00**	**now $95.00**
3 unit	**132mm**	**Natural**	**HB-5415**	**was $105.00**	**now $95.00**

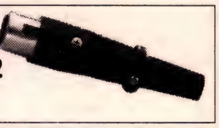
Quality Low Cost Cannon Type Connectors

Why pay more for the originals
ALL CONNECTORS ARE BLACK IN COLOUR.

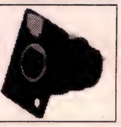
LIFETIME GUARANTEE

3 pin Chassis Male Plug
Cat PP1010
$3.20

3 pin Line Male Plug
Cat PP1012
$3.95

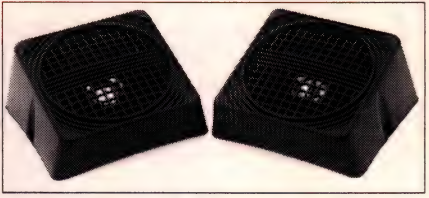


3 pin Chassis Female Metal Black
Cat PS1014
$4.20



3 pin Line Female Metal Black
Cat PS1015
$3.95

Extremely Low Cost Extension / Car Speakers



CAR SOUND ON A 3RD WORLD BUDGET.
When we were told the price of these we had to see a sample! Whilst they are dead set cheap, they work OK! The enclosure itself is moulded in a cheap plastic - so we do not recommend them for rear parcel shelf installations in cars in hot climates. The 4" wide range speaker has a pleasant sound about it though. They will handle about 5 watts RMS (Don't beleive what is printed on the carton), are supplied with about 2 metres (total) of speaker wire which you will have to solder yourself. Ideal for workshops, cool cars, sound blasters etc. Measure 130W x 25H x 63Dmm each.

NEW

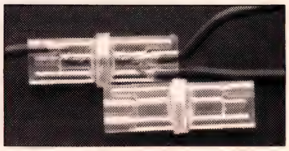
Cat. AS-3150 **Only $6.95 a pair**

Bellmate Pulse Count Passive Infra Red Detector

Used by many alarm installers. The Bellmate 100 has switchable Pulse Count operation with single and 3 pulse triggers which virtually eliminate false alarms. Other features include: •wide angle 90° coverage •15 x 15 metre coverage •sensitivity adjustment •LED indicator •sliding PCB •NC terminals •two year warranty

Cat. LA-5016 **$49.95**

Twist Wire Joiners



NEW GENERATION WIRE JOINERS - AS SEEN ON "BEYOND 2000"

NEW

These joiners are a one piece unit in which one wire is inserted in each end. Each end of the unit is then twisted, which in turn twists the wires together inside. A third wire can be used, so three wires can be twisted together. The wire needs to be stripped first. They will accept wire up to 1.5mm dia, which when insulated measures almost 3mm. The joiner is very strong, safe and has been approved by the Energy Authority of NSW. Features: •strength •easy to use •sealed against ingress of vapours, liquids and gases •VO rated •approved by the Energy Authority of NSW •economical •low resistance •small size 38mm long x 15mm dia. **Cat. HP-1208** **Pkt 10 $4.95**

Mini UHF Coaxial Plug

These plugs look like a mini PL259 and are very popular in the cellular phone installation area. Crimp plug for RG58 cable.

NEW

Cat. PP-0695
Now $2.95

Gaffer Type Tape

Quality US Made

The tape is black in colour, has a non-reflective low sheen and is unbeleivably strong, yet easy to cut to length - even with your fingernail!! This tape is used extensively in the music/PA industry, air conditioning installations, computer cabling, fixing - repairs and other general use. 48mm wide on a 25 metre roll

NEW

Cat. NM-2810 **$11.95**

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New Generation Rechargable AA Penlight Batteries - 1.1A/Hr

NEW

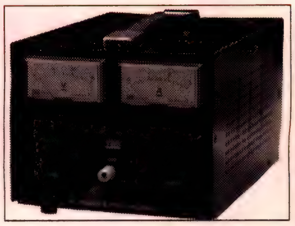
These new generation batteries are Ni-MH which is Nickel Metal - Hydride which is often referred to as the "Green" battery because they are free of toxic or hazardous elements such as cadmium, lead, mercury or lithium.

Advantages of Ni-MH batteries:

- Higher current capacity
- Flat discharge curve
- Recharge for 14 hours at 100mA
- No memory effect
- High drain performance
- Capacity: 1100mAh

Cat. SB-2455 **$7.50**

Variable Lab Power Supply



This pre-built quality 0-30VDC at 3 amps power supply is mounted in a sturdy vented metal case with carry handle on top.

It's made by TES, the company that makes most of our multimeters and test equipment. Output voltage and current panel meters are mounted on the front panel and have large scales for easy reading. For full specifications see our 1994 catalogue. Dimensions: 175(W) x 135(H) x 240(D)mm. Weight: 5.5kgs. Comes complete with instruction manual and safety test leads. Every serious work bench shoud have one!!!

Cat. MP-3090 1 YEAR WARRANTY **$289.00**

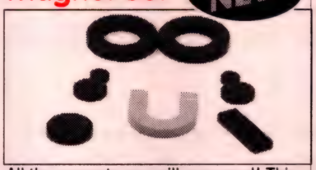
Soldering Iron Station For Under 50 Bucks!!!

Thats Right! Jaycars Temperature Controlled Soldering Station is ideal for the hobbyist or even the work bench. now you finally can afford to buy a soldering station. It operates on 240 volts, and the transformer delivers a safe 16 volts to the soldering iron. It has a PTC (Positive Temperature Coefficient) soldering tip at a constant temp of 310°C which is ideal for PC work. It has a 20 second heatup time. The base incorporates a stand for the iron & a sponge to keep the tip clean. The iron itself has an on/off switch built in. A very good soldering iron at an amazing price.

Soldering Iron	**Cat. TS-1200**	**$49.95**
Replacement Tip	**Cat. TS-1202**	**$9.95**

Magnet Set

NEW



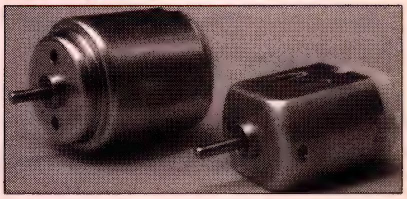
All the magnets you will ever need! This 9 piece magnet set is ideal for hobbyists and children who want to learn more about magnets. Each pack consists of:

2 x small round	Dia: 8mm, Height: 2mm
2 x medium round	Dia: 15mm, Height: 2mm
1 x larger round	Dia: 20mm, Height: 3mm
1 x rectangular	30 x 10 x Height: 2mm
2 x ring magnets	OD: 32, ID: 18, Height: 4mm

1 x horseshoe magnet with north and south pole stamped on it 30 x 30 x Height 4mm

Cat: TH-1872 **$4.95**

Hobby Motors

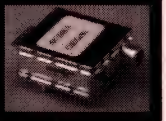


Two models available. Ideal for hobbyist, experimenters, robotics, replacement, etc.

Torque	Low	Medium
Operating Volts	1.5-4.5V	1.5-4.5V
Nominal Volts	3V	4.5V
Speed (no load)	12000rpm	12500rpm
Current (no load)	0.28A	0.25A
Speed (max eff)	8540rpm	9560rpm
Current (max eff)	0.69A	0.81A
Torque (max eff)	7.94gcm	17.86gcm
Size dia	20mm	23.6mm
Size length	25mm	25mm
Shaft length	8.1mm	6.5mm
Shaft dia	2mm	2mm

Cat. YM-2706 Low	**$2.25**
Cat. YM-2707 Medium	**$2.95**

Quality Video/Audio RF Modulator



Our best ever unit. This modulator has been specially built to our stringent specifications. It is a VHF unit switchable to Australian Ch 3 or 4. The audio is placed at the correct subcarrier frequency and output frequency is stable with a good strong signal. Full specifications (and we mean FULL) are supplied with each unit.

Cat. LM-3848 **Was $22.95** **Now $17.95**

Speaker Grill Clamp Kit

As supplied in our 8" to 15" grills. Inc 4 metal lugs 47x25mm. 4 screws and 4 "T" nuts. Colour - all black

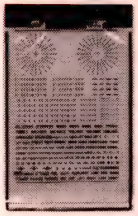
Cat. AX-3540 **$3.95**

CHECK OUT OUR NICAD RANGE

AAA	180mA/Hr	**Cat. SB-2454**	**pr**	**$6.95**
AA	550mA/Hr	**Cat. SB-2452**	**ea**	**$2.50**
AA	720mA/Hr	**Cat. SB-2450**	**ea**	**$3.50**
AA	720mA/Hr with solder tags	**Cat. SB-2451**	**ea**	**$3.75**
C	1.2A/Hr	**Cat. SB-2459**	**ea**	**$5.95**
C	2.25A/Hr	**Cat. SB-2464**	**ea**	**$9.50**
D	1.2A/Hr	**Cat. SB-2460**	**ea**	**$5.95**
D	5.1A/Hr	**Cat. SB-2466**	**ea**	**$16.95**
9V	100mA/Hr	**Cat. SB-2458**	**ea**	**$16.95**

Electronic Lettering Transfer Sheet

NEW



Make your home made amp look professional. This sheet consists of black rub on lettering and symbols commonly used in electronics. There are 0-10 numbers, min/max, words like Volume, Balance, Bass, Treble, Aux, Front, Rear, On, Off, dB, Hz, Mic, Left, Right, Power, Phones as well as symbols for on/off, potentiometers, arrows etc. 1 sheet measuring 145 x 210mm supplied.

Cat NL-2920 **$3.95**

Headphone Bargain

Another surplus stock purchase, lightweight 3.5mm mono plug (use an adaptor or solder on a stereo plug for stereo headphones). 32 ohm impedance. Limited quantity available

Cat AA-2000 **$1.95**

NEW JAYCAR DEALER IN WESTERN AUSTRALIA
FORUM ELECTRONICS
Shop 46 Mandurah Forum Shopping Centre
Mandurah. Ph: (09) 581 3466 or 581 3403

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

POST & PACKING	
$10 - $24.99	$ 3.75
$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
OVER $100	$ 8.00

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ROAD FREIGHT ANYWHERE IN AUSTRALIA (up to 20kg) $14.00

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BURANDA QLD	144 Logan Rd Ph:(07) 393 0777 Fax:(07) 393 0045 Mon-Fri 9 - 5.30 Thurs 8.30 - Sat 9 - 4pm
COBURG VIC	266 Sydney Rd Ph:(03) 384 1811 Fax:(03) 384 0061 Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 4pm
MELBOURNE CITY	Shop 2, 45 A'Beckett St City Ph:(03) 663 2030 Fax:(03) 663 1198 Mon-Fri 9-5.30 Fri 8.30 Sat 9 - 2 Sun 10 - 4pm
SPRINGVALE VIC	887-889 Springvale Rd Mulgrave. Nr Cnr. Dandenong Rd Ph: (03) 547 1022 Fax:(03) 547 1046 Mon-Fri 9-5.30 Fri 8.30 Sat 9 - 2
SYDNEY - CITY	129 York St. Ph:(02) 267 1614 Fax(02) 267 1951 Mon-Fri 8.30 - 5.30 Thurs 8.30pm - Sat 9 - 4pm
BANKSTOWN	363 Hume Hwy Cnr Meredith St Ph:(02) 709 2822 Fax:(02)709 2007 Mon-Fri 9 - 5.30 Thurs 8.30pm Sat 9 - 4 - Sun 10 - 4pm
GORE HILL	188 Pacific Hwy (Cnr. Bellevue Ave) Ph:(02) 439 4799 Fax:(02) 439 4895 Mon-Fri 9-5.30 Thurs 8.30 Sat 9-4pm Sun 10-4pm
PARRAMATTA	355 Church St (Cnr. Victoria Rd) Ph:(02) 683 3377 Fax:(02) 683 3628 Mon-Fri 9-5.30 Thurs 8.30pm Sat 9-4pm Sun 10am - 4pm
PENRITH	199 High St Ph:(047) 21 8337 Fax:(047) 21 8935 Mon-Fri 9-5.30 Thurs 8.30 - Sat 9-4pm Sun 10-4pm
RHODES	6 Leeds St Ph: (02) 743 5222 Fax: (02) 743 2066 Mon-Fri 9 - 5.30

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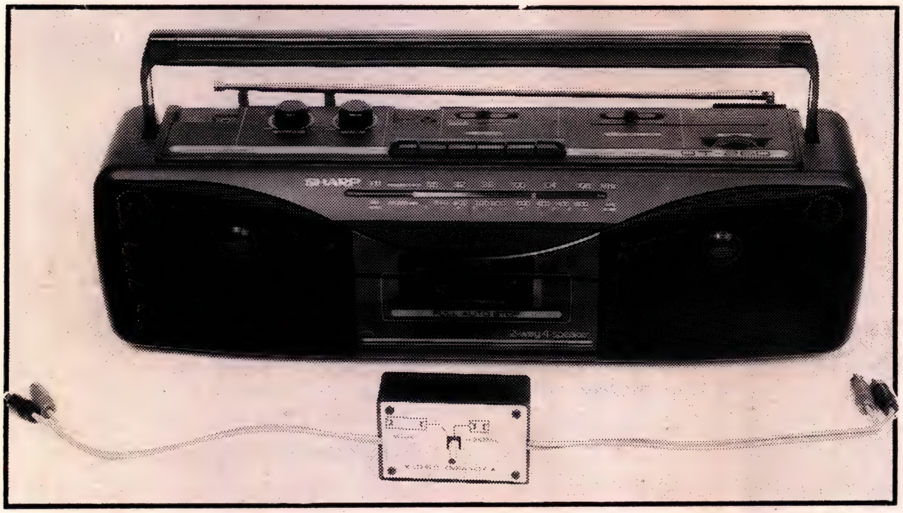
Experimenting with Electronics

by PETER PHILLIPS

Enhancing stereo sound

We experiment with stereo sound processing this month. Using just a handful of components and a low cost operational amplifier IC, we show two ways to broaden the stereo image from closely spaced speakers.



Since taking over this section of the magazine, I have set myself the task of providing interesting and inexpensive experimental designs suited to both beginners and professionals.

This month I've chosen audio, as most readers of this column will have an interest in sound. All you'll need for the circuits I'm describing are a stereo system you can 'break into' (electronically speaking), an op-amp or two and a few resistors and capacitors.

I'm describing two circuits that do much the same thing — enhance the stereo sound from a sound system. Let's start by looking at why you'd want to do this, then I'll explain each circuit in turn.

Stereo enhancing

When stereo sound is replayed through closely-spaced speakers, as in a portable 'ghetto blaster', the width of the sound image is reduced to about that of the speaker separation. This means you virtually lose the effect of a 'wide' sound and end up with an almost monaural sound. This is only to be expected of course, as we perceive stereo sound by pinpointing the location of each sound source that makes up the total sound. So if the individual sound sources are close together, you can't expect to hear a wide sound.

Manufacturers have long recognised this, and quite a few brands of TV sets and portable cassette players have some sort of stereo enhancement built in. This feature might be called 'spatial stereo', 'wide sound' or anything that suggests the stereo sound has been fiddled with. Purists wouldn't have a bar of such a thing, but then a purist wouldn't have speakers close together!

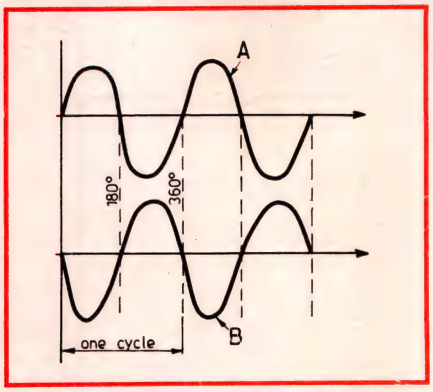


Fig.1: Waveform B is inverted (or 180 degrees out of phase) with waveform A.

Probably the simplest way to fool the ear into hearing sound that appears to come from all over the place is to connect one speaker in a stereo system so it's *out of phase* with the other. This means its cone moves the opposite way to that of the other speaker when the same signal is applied to both speakers.

The effects of this are a reduction in the bass content, and a 'hole in the middle' effect, because there's no centrally placed sound. The volume of the low frequencies is reduced because one speaker cone moves so it cancels the other. This is only noticeable with low frequencies (below 100Hz), as they are usually recorded at equal levels on both channels to give the sound system the best chance to reproduce the bass. Separating low frequency sound is relatively pointless anyway, as the ear can't resolve its location, and having both speakers move the air mass makes sense.

However, frequencies over a few hundred hertz are fair game for stereo separation. A central image is achieved by having each speaker produce an equal level of sound output, as in a mono recording. An off-centre image is created by one speaker producing more output than the other.

But if one speaker is phase-reversed, the sound placement becomes the opposite of what it should be, creating the 'hole in the middle' effect, which confuses the listener. So simple phase inversion of one channel is not the answer, as the sound created is neither satisfying nor believable.

However there's a lesson in this. Obviously if phase inverting one channel can create a wider (if confusing) image, then fiddling the phase content of the

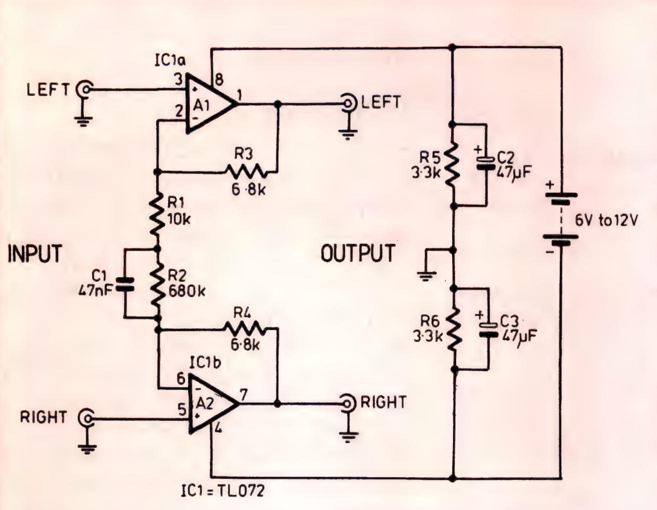


Fig.2: This stereo enhancing circuit couples frequencies above 2kHz via R1 and C1 to the inverting input of the opposite channel. The output of each channel therefore contains phase inverted components of the other.

stereo channels must have the potential of producing a widening effect. If done correctly, the bass content should not be affected, and a central image should still be present.

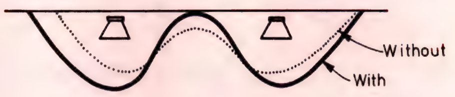


Fig.3: This diagram shows the effect on the stereo image caused by the circuit of Fig.2.

Frequency selection

Phase inversion of an electrical signal means, in effect, turning it upside down relative to another signal. This is shown in Fig.1, where waveform B is 180° out of phase with waveform A. The phase relationship between two waveforms can be anywhere between 0° (in phase) through 180° (exactly out of phase) to 360° (back in phase).

We are only interested in one signal being 180° out of phase with another, and this can be achieved with an op-amp. However, we don't want the bass signals to be affected, so one way is to use a frequency selective network to make sure only the higher frequencies are modified.

The first of our two circuits is shown in Fig.2. As you can see, it's pretty simple, and can be powered from a single 6V to 12V battery. Its operation is quite cunning, and is based around R1 and C1. There are basically two modes of operation: when C1 is an open-circuit and when it's a short-circuit. Let me explain...

A capacitor has the property of capacitive reactance, which is its 'resistance' to AC. Capacitive reactance *decreases* as the frequency increases, which means high frequencies are passed through more easily than low frequencies. The equation to find capacitive reactance (Xc) is 1/(6.28fC), where f is the frequency in hertz, and C the capacitance in farads.

The value of C1 in Fig.2 is 47nF, so its capacitive reactance at 200Hz is around 16.9k ohms. At 2kHz its capacitive reactance is 1.69k ohms and at 20kHz it's only 169 ohms. As far as the operation of the circuit is concerned, C1 can be regarded as an open-circuit at 200Hz, and a short-circuit for frequencies above about 2kHz. That's not strictly true as you can see, but it's a reasonable approximation to make here.

Now let's regard the circuit as having only one input signal, say to the left channel. This signal will appear at the output of A1 with the same phase as the input. In fact, it will also be about the same amplitude, as A1 is now behaving as a low gain, non-inverting amplifier.

If this signal is at 200Hz, C1 is an open-circuit (virtually) and the total resistance between the amplifiers is R1 + R2 or around 680k. Therefore, very little of the output of A1 gets coupled to A2. But if the frequency of the input to A1 is increased, more of this signal gets coupled to the inverting input of A2 (pin 6). In fact, about 40% of the output of A1 is coupled to A2 for frequencies above about 2kHz.

Because this signal is applied to the *inverting* input of A2, it appears at the output of A2 but 180° out of phase with the signal at the output of A1. So, a signal at one input of the circuit is appearing at both outputs, with one output phase-reversed to the other. As well, the phase-reversed output is about 40% the level of the other.

The same theory applies to a signal applied to the right channel. Again a

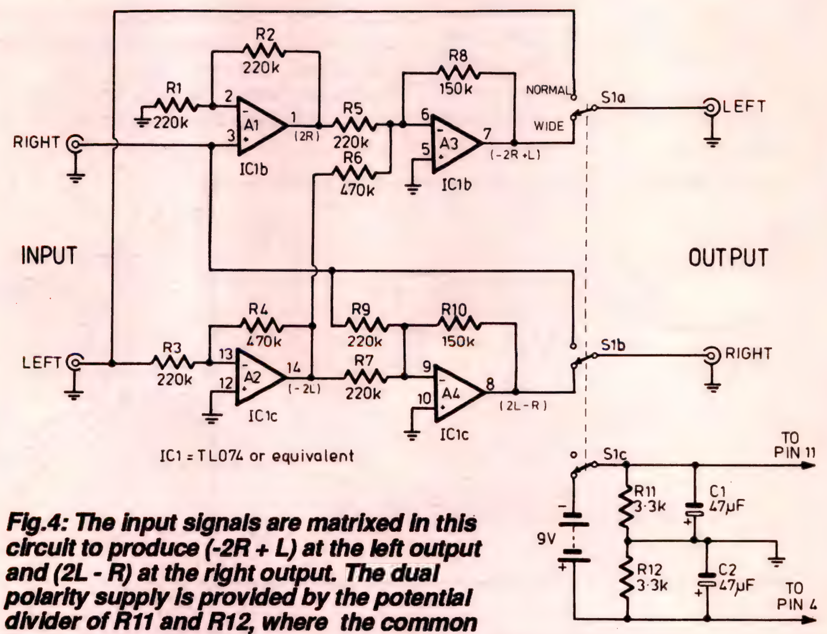


Fig.4: The input signals are matrixed in this circuit to produce (-2R + L) at the left output and (2L - R) at the right output. The dual polarity supply is provided by the potential divider of R11 and R12, where the common line is the junction of the two resistors.

portion of the output of A2 is fed to the inverting input of A1, giving a phase-reversed signal at its output, about 40% the level of the output at A2.

When signals are applied to both inputs, as is the normal case, 'cross-pollination' between channels will occur both ways, giving two output signals that contain phase-reversed components of the other channel.

Notice that the bass signal hasn't been transferred between channels, so there's no loss of bass. However, the treble content will be slightly higher as there is now more of it in the total signal.

If you have an audio oscillator, try connecting it to one input of the circuit, with the outputs of the circuit connected to a stereo audio amplifier. You'll find that as you increase the frequency of the input signal above say 200Hz, the output of the channel not otherwise receiving a signal will increase. As well, you'll hear a 'hole in the middle' effect, because the two signals you are listening to are out of phase.

The subjective effect

There's an old saying in the audio industry — never mind the instruments, what does the ear tell you! The human ear is particularly good at discerning differences, though it's not much good at measurement. So the ear can't measure the sound spread, but it *can* hear it.

You'll notice the difference in the stereo image caused by this circuit mainly when the speakers are close together. The effect the circuit has is shown in Fig.3, which shows not to expect a mind blowing spaced-out sound, although you'll hear the effect quite clearly on an A-B test. The difference will also depend on the type of music — as being frequency conscious, it can only respond if the frequency content is available.

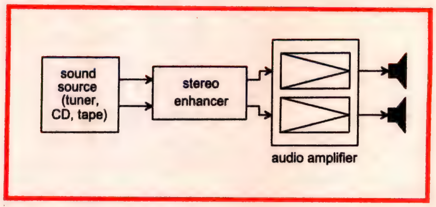


Fig.5: Connect either of the enhancing circuits into an audio sound system as shown here.

If you make R1 variable, you can change the effect the circuit has on the sound, although decreasing R1 to zero will cause distortion and a gross increase in the treble content. The change in the sound separation is not dramatic for variations in the value of R1. Now to the next circuit.

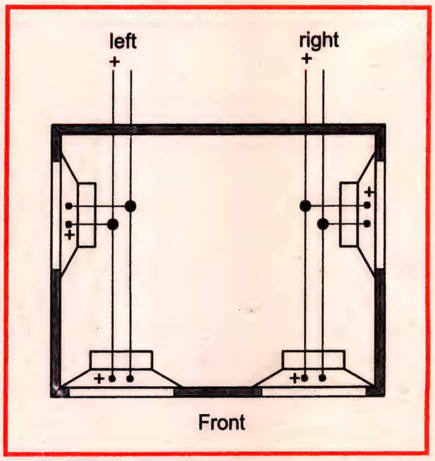


Fig.6: This speaker arrangement, when used with a stereo enhancer gives improved sound separation and increases bass. The side speakers can be smaller than the front speakers.

Matrixing

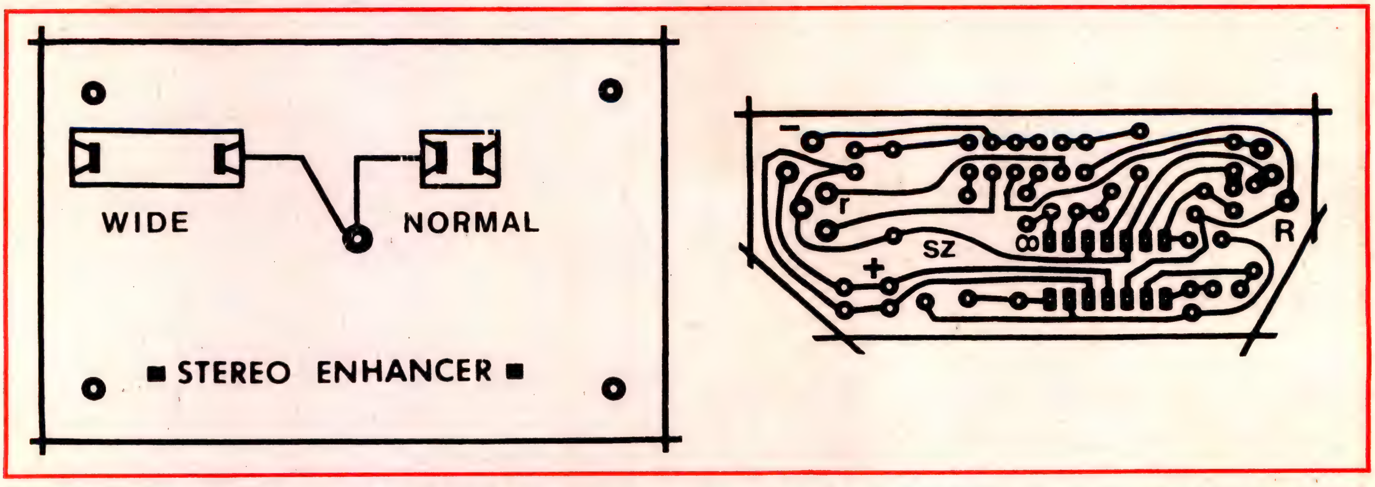
The next circuit, shown in Fig.4, uses a more mathematical approach. Amplifier A1 is a non-inverting amplifier with a gain of two, and the signal at its output is therefore 2R. Amplifier A2 is an inverting amplifier, also with a gain of two, producing -2L at its output. The minus sign means 180° out of phase, so the output is therefore inverted compared to the input.

Amplifiers A3 and A4 are both wired as summing amplifiers, and receive two inputs each. If the value of R8 is assumed to equal that of R5, the output of A3 is -(2R - L). This sign cancels to (-2R + L). This is because the signal from A1 (2R) is amplified by one, with the output of A2 (-2L) amplified by 0.5. In fact, the value of R8 has been chosen to produce an overall gain reduction to maintain a subjective volume level of unity. Similarly, A4 produces the output signal -(-2L + R), which sign cancels to (2L - R). Notice that the two components in each output signal are out of phase to each other.

If a mono signal is applied to the circuit, the effect on the sound will be the same as having one speaker reversed, as the right channel output will be -R, and the left channel will be +R (as L = R, for a mono signal).

But when a stereo signal is applied, the matrixing will cause all kinds of effects. Because the circuit is not frequency dependent, the bass sound will be reduced. However, the apparent width of the sound is greatly increased, and is very noticeable.

Amplifier A1 is not essential to the operation of the circuit, as the R input could have been connected directly to



The front panel design (left) can be used with either circuit. The PCB pattern on the right for the circuit of Fig.4 is shown actual size for those who can brew their own.

A3, via R5. The value of R5 would need to be reduced by half to retain the gain of two. However, doing this would cause the input resistance of each channel to be different, and as the IC has four op-amps anyway, why not use it. The input resistance of each channel is 220k, which is high enough to prevent any significant loading effects.

The power supply

You'll notice that both of the circuits we've described use the same power supply arrangement. Op amps usually need a dual polarity power supply, which normally means two batteries if the circuit is battery powered. In these circuits, the dual polarity supply is simulated by the two 3.3k resistors. It works on the assumption that the current values from both the positive and negative supplies are equal, which is the case for these circuits. The common line is the junction of the potential divider formed by these resistors.

Because the supply voltage from a 9V battery means the positive and negative supplies to the op-amp are 4.5V, the output voltage swing of the circuit is limited to around 6V peak-peak for a 9V supply. However, this should be more than adequate for most applications.

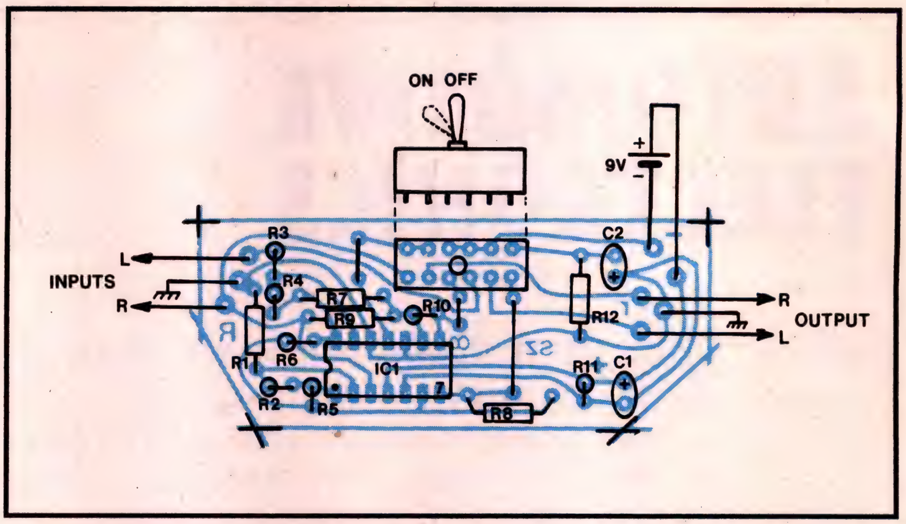
The switch in Fig.4 switches the signal either directly from inputs to outputs, or from the inputs, via the enhancer then to the outputs. It also turns on the power to the circuit when the enhance position is selected. This arrangement can also be used in Fig.2. You need a three-pole, double-throw switch (toggle, wafer or slide switch) for this.

In practice

The first circuit was tested by building it on a breadboard and connecting it to a power amplifier. It's simple enough to build on strip board, or even on matrix board.

The second circuit has a printed circuit board and is a project I developed some time ago. It originally appeared in the October 1988 issue of *Electronics Today*, and is repeated here as it is ideal for this column. Incidentally, the circuit description in *ETI* has a few minor errors.

Again this circuit is simple enough to build on strip board, but I've included the PCB design and layout if you can make your own board. However, the switch used in the prototype may be hard to find now. Any equivalent switch will do, except it may not fit the PCB design. Connect it with short leads to the board.



This is the layout diagram for the circuit of Fig.4. Use any suitable switch for S1, connected with short leads to the PCB.

This unit is shown in the lead picture, in front of my daughter's tape recorder. It was built inside a small plastic box (28 x 54 x 83mm).

The PCB was held to the metal lid of the box by screws through the switch, with a label over the lid to cover the screws. The input leads (shielded cable) were fitted with RCA line sockets, with RCA line plugs on the output leads (also shielded cable).

To use either circuit, connect it between the signal source and the amplifier normally connected to the source, as in Fig.5. If you want to integrate it with a portable tape-radio unit, connect it between the output of the signal select switch and the amplifier in the unit. That is, cut the lead (or PCB track) from the common terminal of this switch and connect the enhancer in series. Naturally there should be two outputs from the switch; the left and right channels.

PARTS LIST

Circuit 1

Resistors

All 1/4W, 5%

R1	10k
R2	680k
R3,4	6.8k
R5,6	3.3k

Capacitors

C1	47nF polyester
C2,3	47uF 16V electrolytic

Semiconductors

IC1	TL072 dual op amp

Miscellaneous

Battery (6V to 12V) and battery clip; strip board or matrix board; shielded lead; 8-pin IC socket; hookup wire to suit.

Circuit 2

Resistors

All 1/4W, 5%

R1-3,5,7,9	220k
R4,6	470k
R8,10	150k
R11,12	3.3k

Capacitors

C2,3	47uF 16V electrolytic

Semiconductors

IC1	TL074 quad op amp

Miscellaneous

3PDT switch (the PCB design was for a 4PDT switch, DSE cat. no S-1301, probably no longer available); PCB, strip board or matrix board; shielded lead; 8-pin IC socket; hookup wire to suit.

You can increase the separation effect, and also improve the bass response by using a speaker arrangement like that shown in Fig.6. For example, if you have a mono TV set and a stereo VCR, arrange the additional speakers inside the TV cabinet as shown. The advantage is that people anywhere in the room will hear the sound in stereo. Obviously a stereo power amplifier is needed to drive the speakers, with the enhance circuit between the VCR output and the input to the amplifier.

So which circuit is best? The first doesn't give the width of separation as the second, but the bass response is not affected. As well, a mono signal is not affected by the first circuit, where it is totally destroyed with the second.

Although the stereo separation effect is reduced, you could try reversing the phase of one speaker when you use the second circuit. This will improve the bass and correct the central image, but the stereo spread won't be quite as effective.

You might also try building both circuits and connecting them in series. By switching each circuit individually, you can get a number of effects that best suit the sound.

Either way, there's enough ideas here for you to experiment with, all for the cost of few bits. Have fun! ❖

AUTOMOTIVE ELECTRONICS

with MAJOR AL YOUNGER (USAR, Ret.)

Rolling your own analyser, with 'Visual Designer'

I am still getting letters on the December article, about using a PC to analyse and display ECU data, for speedy fault diagnosis. Here's the low-down on doing this using *Visual Designer*, a PC Data Acquisition/Analysis/Display/Control package which lets you achieve what's needed without having to get yourself a diploma in computer programming.

To use a PC for diagnosing faults in a modern car, the name of the game is *data acquisition.* You need a PC, the right interfacing hardware (data acquisition boards) and of course a program to let you change things (control), look at how the system responds (acquisition), and then work out what the car's system is telling you (analysis and presentation).

There are many companies in this general data acquisition business, mostly supporting the industrial or manufacturing sectors. Their products are all 'off the shelf' general purpose items, but in theory at least they should be capable of being adapted for automotive use. All that's really required is physical access to the auto's computer (the right interfacing cards and cables), plus a software package that lets you do what's needed without a lot of high-powered programming.

The interfacing cards are now fairly readily available, although they're not particularly cheap.

On the software side, perhaps the most promising developments are the recent appearance of new *Windows*-based or 'Windows like' packages for data acquisition, which let you 'program' by virtually drawing the system you want as a schematic, right on the computer screen.

To see what can be done using this approach, I decided to try out a package called *Visual Designer*, chosen at random from an advertisement in *EA*. So I simply called the company which advertised it (Kenelec), and they kindly sent me a review package containing three demo disks and a few kilos of manuals.

Visual Designer

Produced by a firm in Tucson, Arizona called Intelligent Instrumentation (part of Burr-Brown), *Visual Designer* works in the *Windows* environment, as a powerful, easy-to-use application generator for PC based data acquisition, test, measurement and control. It lets you 'create' application software customised for your own requirements. No other programs are required, nor do you have to master a programming language to make it work.

Basically it allows you to capture, record, manipulate, analyse, display, output data and control devices. Software-emulated 'display devices' available include chart recorders, panel meters, oscilloscopes, spectrum analysers and more.

To use *Visual Designer*, you need a PC with a mouse, a data acquisition board, an interface box and software (Fig.1).

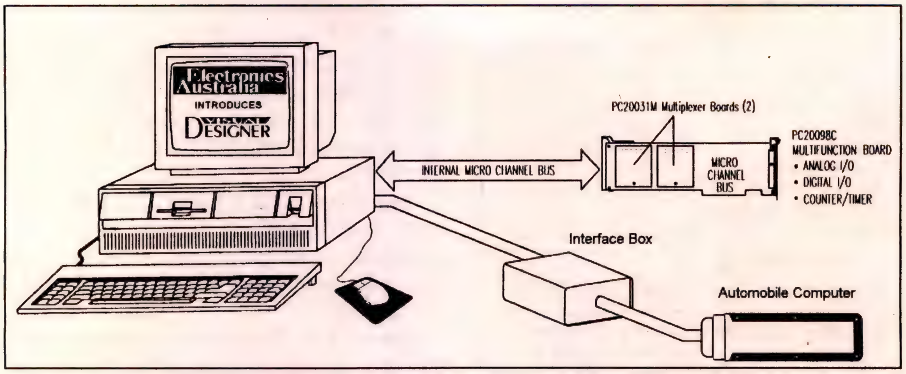


Fig.1: Visual Designer helps get your PC communicating with a car computer.

The basic system requirements to run the package are:

- IBM-compatible 80386DX/80486 PC
- 10MB free hard disk space
- VGA graphics
- Microsoft *Windows* 3.1
- 4MB minimum RAM (8MB preferred)
- A *Windows*-supported printer

Visual Designer is designed to work with a range of PC data acquisition boards which Intelligent Instrumentation also markets. For our kind of auto diagnostic work, where a total of 64 analog channels is required, you need a PC-20098C (PC98C) Multifunction Board and two 'piggyback' PC20031M (PC31M) Multiplexer Boards. The PC98C is inserted into a slot in the PC's Microchannel bus, while the PC31M's plug into the PC98C. You must write down the main board designation, in this case the PC98C, as the program will ask for board identification.

To facilitate making the physical connections between computer board's I/O channels and those of the car computer, you need an interface box. A traditional 'breakout box' (BOB) could probably be modified for this purpose, with a connector system which allows hooking-up the PC to many different car systems.

How it works

Now many of you *EA* readers may have built one of the magazine's construction projects which turn your PC into a waveform generator, digital storage scope or whatever. Well, this setup works the same way, only more so. Its combination of hardware and software gives you a precision voltmeter (analog or digital), a complex waveform generator, a CRO (cathode ray oscilloscope) or a spectrum analyser. You can even design your own custom type of tester.

When it's not in use testing cars, you

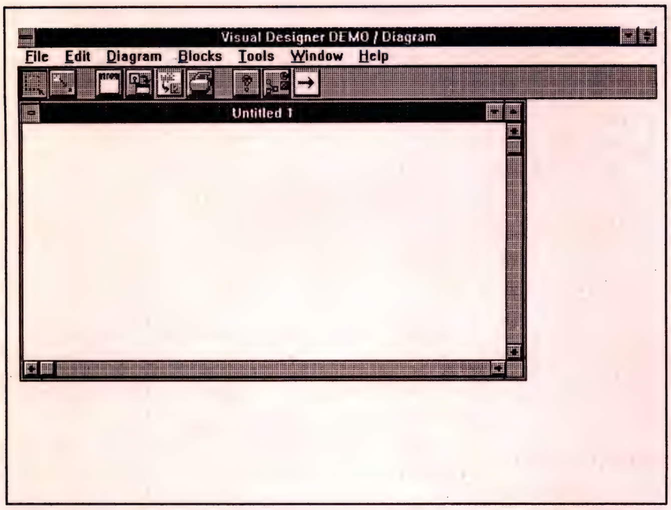

Visual Designer DEMO / Diagram
File Edit Diagram Blocks Tools Window Help
Untitled 1

Fig.2: Visual Designer's opening screen.

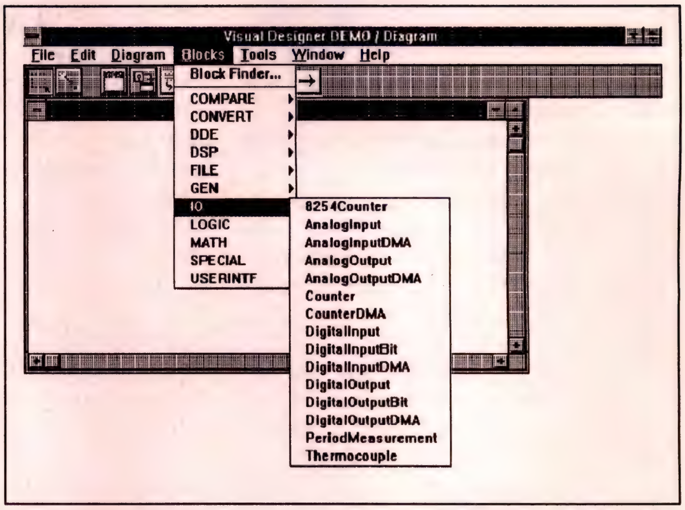


Fig.3: Starting to draw a schematic, by adding I/O blocks.

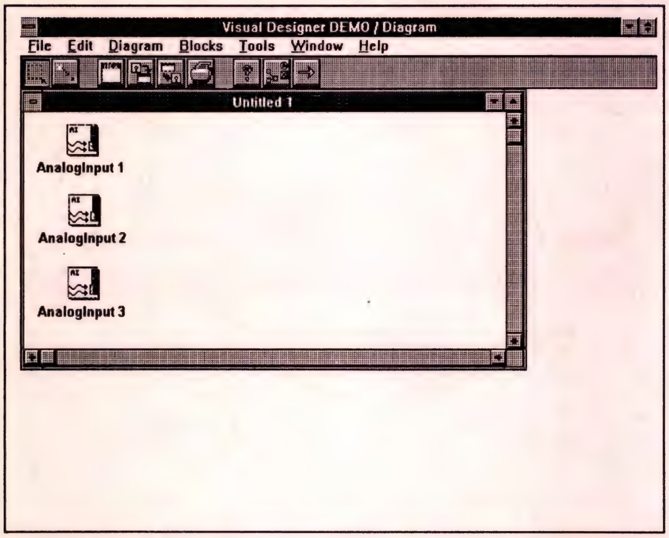

Visual Designer DEMO / Diagram
File Edit Diagram Blocks Tools Window Help
Untitled 1
AnalogInput 1
AnalogInput 2
AnalogInput 3

Fig.4: Three analog input blocks in place on the schematic.

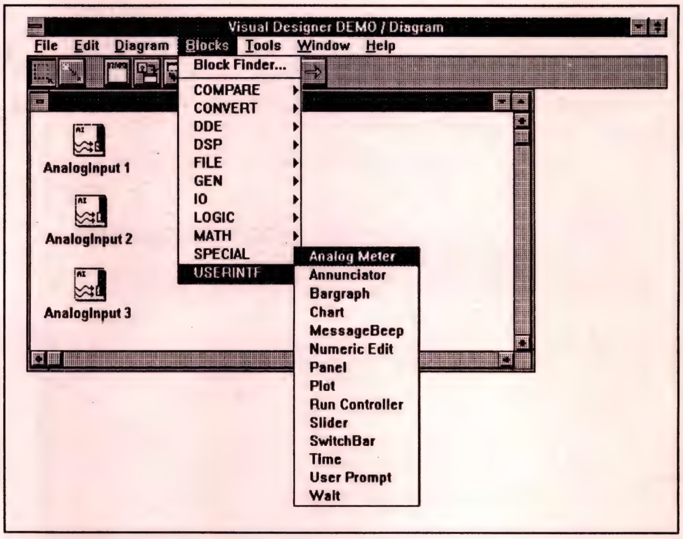


Fig.5: Now we begin to add readout device blocks...

can use it to control your home or workshop security alarm system.

But let's see how easy it is to use. The demo program requires just over six megabytes of space on the hard disk (HD) drive. The program is installed in the *Windows* environment, simply by putting disk 1 in your floppy drive A (or B), then clicking on 'RUN' in the Program Manager File menu, and typing '**A:** (or **B:**) **install.exe**'. The program is installed as a temporary directory on the HD drive. This allows you to completely delete the program without leaving files or corrupting your INI files. As the program is installed it's pretty dramatic, as all the component files are graphically displayed as they're installed.

Starting it up

After it's installed, you just double-click on the *Visual Designer Demo/Diagram* icon and you're off and running. When the program is ready to go, it looks like Fig.2.

To start building your diagnostic system, you just go to BLOCKS, on the top menu line, click on it with your mouse, and pull down to I/O. This gives you a second menu (Fig.3), from which you can select the type of block you want — say AnalogInput. If you do this three times, you'll have something like Fig.4.

Now let's provide some readout devices. Click on BLOCKS again, and this time select USERINTF. This gets you another secondary menu (Fig.5), from which you can select say an Analog Meter, a Bargraph and a Panel.

With this done, the next step is to tell *Visual Designer* how we want to interconnect each I/O channel to one of the readout devices. To do this, we must click on the 'arrow' button (second from the left) on the top tool bar (underneath the menu line, Fig.2), then drag a line from say the AnalogInput1 icon to the Analog Meter 1 icon. When you release the mouse button, the screen changes to a dialog box (Fig.6).

At this point you select the information which describes the input device, readout device and type of connection between them, and then click on the 'OK' button. The schematic will re-appear on the screen, with a solid arrow between the icons. This procedure is repeated to make all of your 'connections'.

To save your 'program' you click on the 'panel arrow' button, select a name, then save (to run the program it must first be saved). Then you click the arrow again. The program will promptly load and run. If there's an error the program will let you know by listing the error.

That's the basic way *Visual Designer* is used, to build a data acquisition/analysis system for this kind of work. So if you really want to know what the car computer is up to, you can go wild. For example we can read data from all the car computer pin-outs, display it and save it. Or we can generate our own testing signals, feed them out to the computer and watch how it reacts.

Let's take a look at some selections that are possible.

Fig.7 shows a simple *Visual Designer* setup for testing individual sensors. The specification data used for comparison can either be factory specs, or from tests you've made on actual sensors previously. This data is used as a reference, against which the program compares the output of our selected sensor.

It's easy to add 'bells and whistles' as you can see, to activate an alarm if the sensor output is too high or too low, or produce a 'beep' and show a 'PASS' indication if it's within specs.

Similarly Fig.8 illustrates a setup for recording ECU system data — say vacuum, throttle position and RPM, and then playing them back and displaying them on 'meters' on the screen. As long as the data in each case is within the channel range specifications, we can read it, record it and play it back at a later time.

Getting a display

To illustrate how one of these schematic diagrams turns into a panel display when your program is running, look first at the diagram of Fig.9. Say this is our system diagram, and we've decided that it's workable.

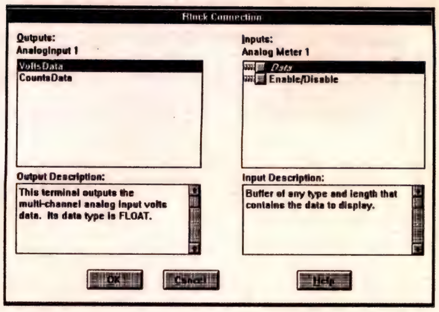
All that is needed now is to click on the arrow tool button, which converts the diagram to a flowcode, and saves it. Then clicking on the arrow tool again RUNs the saved program, and you get a screen like Fig.10. This is in fact the graphic representation of the system we defined in Fig.9.

Visual Designer's test instruments are not only displayable, but controllable using the mouse. For example Fig.11 and Fig.12 show the schematic and display for a system with a Scope and a Spectrum Analyser, both of which can be 'adjusted' in operation using our mouse.

As well as letting us look at data in our car ECU system, *Visual Designer* also has system control functions which will lend themselves to simulating the output from certain car sensors. A temperature sensor or exhaust gas oxygen sensor simulation is easy, since these sensors just produce an analog voltage. But sensors that output frequency, duty cycle or precise pulses could also be simulated, with very little effort.

Very flexible

After trying out the demo version of this package, my impression is that with a little innovation in terms of hardware interfacing, it could be made to test just



Block Connection

Outputs:
AnalogInput 1

VoltsData
CountsData

Inputs:
Analog Meter 1

Data
Enable/Disable

Output Description:
This terminal outputs the multi-channel analog input volts data. Its data type is FLOAT.

Input Description:
Buffer of any type and length that contains the data to display.

Fig.6: Adding the block connections.

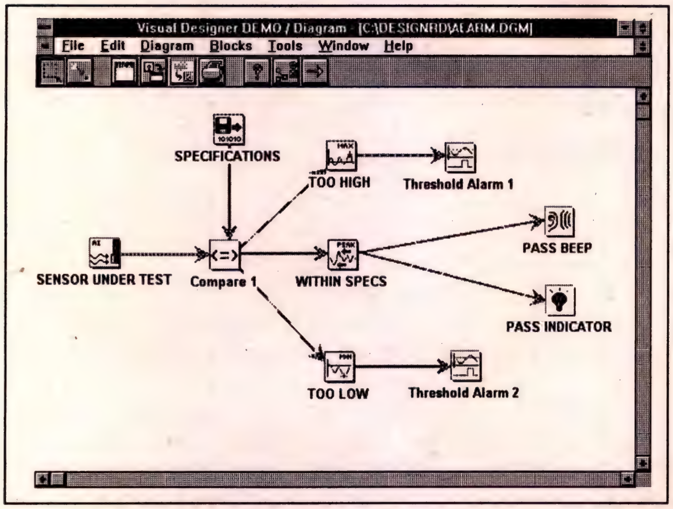


Fig.7: A simple Visual Designer setup for sensor testing.

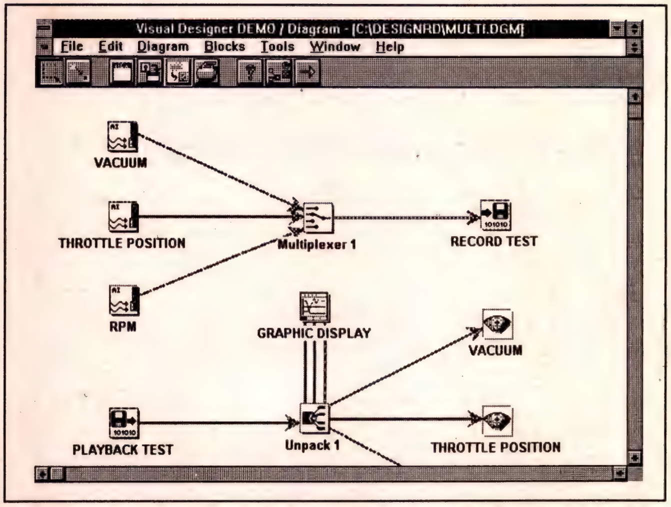


Fig.8: A setup for recording ECU data and replaying it.

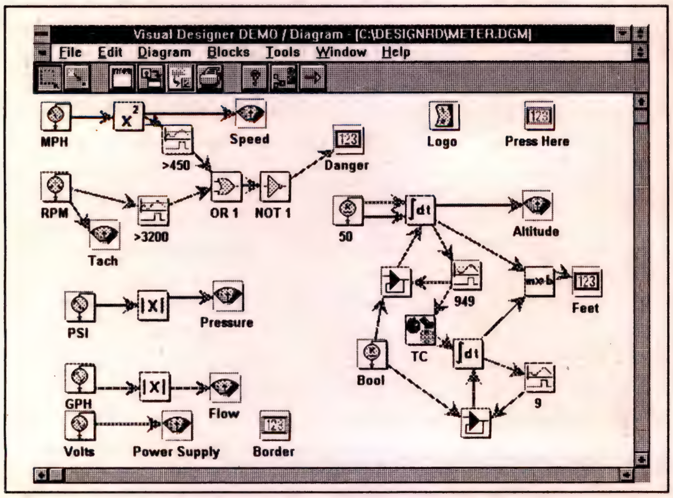


Fig.9: The schematic for a diagnostic system...

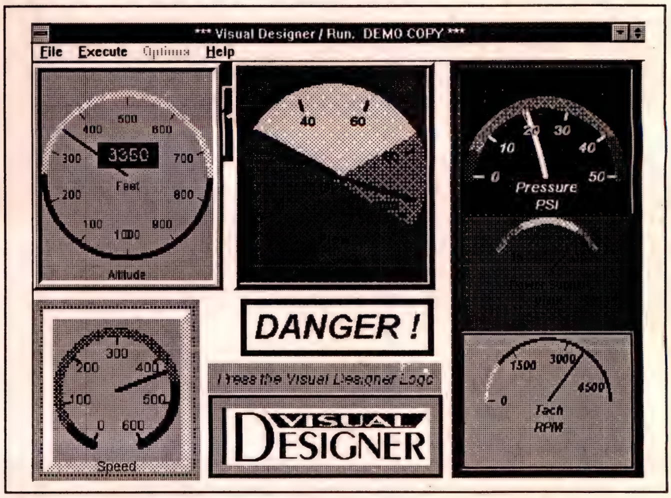

*** Visual Designer / Run. DEMO COPY ***
File Execute Options Help
3350
Feet
Altitude
40
60
Pressure
PSI
DANGER !
Press the Visual Designer Logo
VISUAL DESIGNER
Speed
Tach
RPM

Fig.10: ...And the panel display it produces, when it runs.

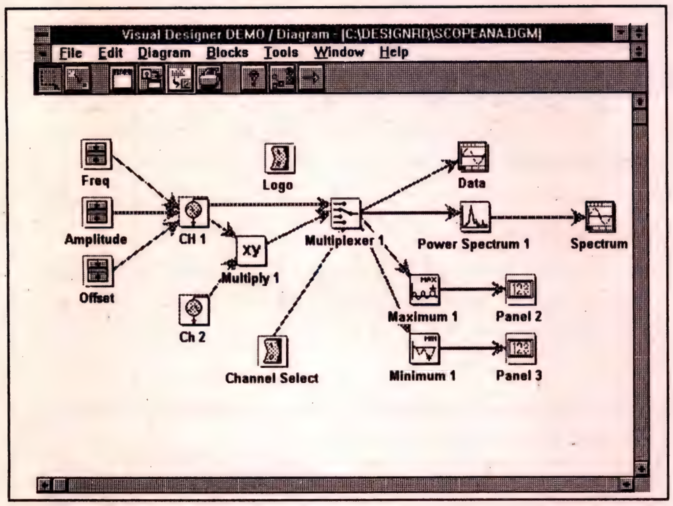


Fig.11: The schematic for a demo measuring system with a scope and a spectrum analyser.

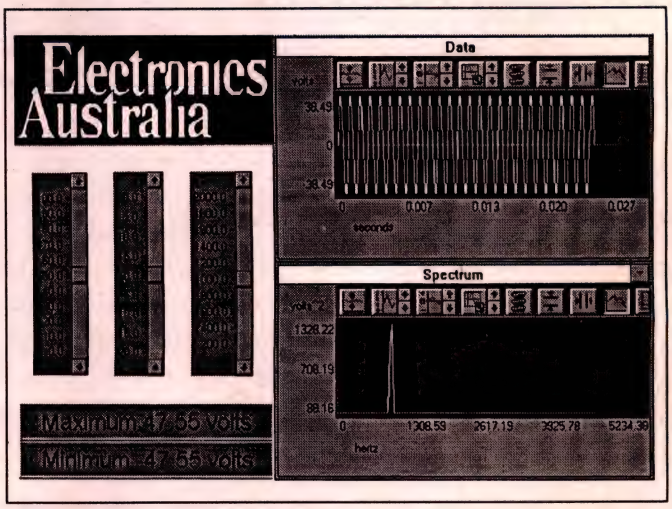


Fig.12: The display produced by the schematic of Fig.11, when it is running. Sorry about that outdated EA logo!

about everything on the car — including the ignition system. All you'd need to do is drop the signal voltages to a safe level, so as not to damage the boards.

Incidentally, some caution has to be taken when interfacing your PC to the car computer. Some circuits have high voltage components, spikes, etc., that may damage the PC's data acquisition boards. Take special care with any circuit with an inductor in it; these will almost always have spikes, and must be conditioned properly.

By the way, you'll notice that I haven't gone into the data acquisition board specifications, other than to state their capacity in terms of I/O lines. That's because in most cases their sampling rates, resolution, etc., are so high they're almost 'overkill' when you're working with an automobile system that operates in the milliseconds range.

Summary

I don't know about you readers, but I always read software books last — that is, when I'm in trouble. Mostly I just browse quickly through the books, noticing any particular cautions. With *Visual Designer* I just started in pulling down menues and having a go at it.

I did have some trouble generating suitable programs for testing. One problem, and it's not mentioned in the book as far as I can see, is if you want to label a schematic Block, you have to select and highlight it using the mouse, and just start typing. I had to call Kenelec's Sydney representative to find this out. But the technical support is on the superior side, as all my calls were answered within the hour, even when the rep was out of town.

Basically, though, with *Visual Designer* the path to designing a test setup involves just three easy steps: (1) Select, (2) Connect and (3) Manipulation (Acquire, Record, Analyse, Process, Display and Control). I'm sure a lot of you *EA* readers would therefore find it a practical way to use their PC for testing cars, given the right interfacing hardware.

What's it all cost, though? Well, at present the *Visual Designer* software package costs $1160. The matching Intelligent Instrumentation main board chosen, PC200098C, and the two 'piggyback' boards (PC200031M), will cost you just under $3000 more.

This setup covers 64 channels, which on many vehicles is an overkill. But of course many autotechs want a system that can check all the pins on a connector, even though all may not be used on all applications.

For more information on both *Visual Designer* and the Intelligent Instrumentation I/O cards, please contact Kenelec at Unit 1, 163-173 McEvoy Street, Alexandria 2015; phone (02) 550 5133 or fax (02) 550 1080. They also have a head office in Melbourne, at 2 Apollo Court, Blackburn 3130; call (03) 878 2700 or (008) 335 245, or fax (03) 878 0824.

Correction

In my review of the DEFIA handheld test instrument, in the April issue, I stated in the summary that the DEFIA would not read all IPWs (injector pulse widths) correctly.

This is not correct. I was told (after publication) this was only true of a few first units, which were returned for factory upgrade at no charge to the customer. I understand that *other* competitive units on the market may have trouble reading IPW, but *not* the DEFIA. Sorry for the mistake.

Incidentally I have also received letters asking about the power transformer I used for my Add-on Amplifier for Surround Sound construction project. I used an Antrim F2014 160VA 18VX2 transformer, from Harbuch Electronics. ❖

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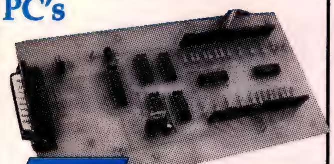
Regards Jack O'Donnell

Stepper Motor Controller Kit for PC's



NEW

(See SC Jan '94) Stepper motors are very useful devices. From robotics to disc drives, they are used widely. The article supplied describes stepper motor types, how to identify, connect and drive them. The kit will work with both uni and bi-polar stepper motors. Connects to the parallel port of your computer. Requires external 12V DC supply.

K 2830 $39.95

K 2832 Software to Suit 3.5" Disk **$14.95**

Low Cost Digital Storage Oscilloscope Kit for your PC

(See EA Jan '93) Thinking that DSOs are too expensive? Well think again! This kit connects to a standard printer port of an IBM compatible and gives you a 60kHz bandwidth to sample with. The software enables viewing, zooming, and disk access of the stored data.

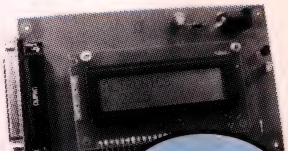
New document files supplied on the disk explain how to modify the kit to make it run in real time. Requires a 9V DC supply.

K 2805 $63.50

K 2806 PC 5.25" Disk Software to Suit

K 2807 PC 3.5" Disk Software to Suit **$19.95**

Alphanumeric LCD Display Kit



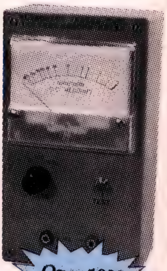
Use Your PC to Control an Alphanumeric Display!

(See SC May '93) This kit makes connecting and using an alphanumeric display dead easy. It connects to your computer printer port and requires a 9V DC supply. Driving notes are described in the article and demonstration software with source code is available. This kit could be used with a single micro chip or even as a program debug display. The applications are limitless. Only $5 more than the cost of the display on it's own! Requires 9V DC.

K 2825 $39.95

K 2827 3.5" PC Software Disk **$14.00**

Megger Meter Kit



(See EA May '89) This design of an electronic meg-ohm meter features a dual voltage of 500 and 1000V with a large scale meter. It can resolve resistance from 1M to 200M ohm which is ideal for insulation testing ***A must for checking earth leakage etc.***

Over 1000 Sold!

K 2555 NORMALLY $79.00

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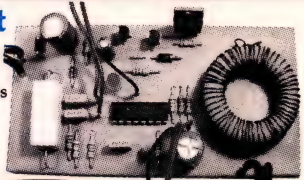
Nicad Fast Charger Kit



(See SC May '94) This kit will allow you to charge your nicads in a very short time. 50 minutes for 600Ah 'AA' and about 100 Minutes for 1.2 AH 'C' & 'D' cells. It can be powered from your car battery, or any other 12V DC source. Can be configured to charge 2 or 4 batteries at a time. Includes a built-in timer circuit to prevent over charging and utilises a switching controller to create a high efficiency charge.

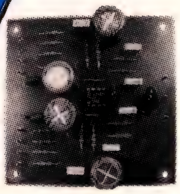
K 1665 $49.95

Charge up to 4 AA Nicads in Less than 1 Hour! Ideal for Remote Controlled Car Enthusiasts etc.

NEW

Universal Pre-Amp Kit

NEW



(See SC April 1994) Do you want to play records on your new stereo system but your system doesn't have phono inputs? Or boost your microphone to a higher output level. This is possible with the latest low-noise universal preamplifier. The K 5512 pre-amps offers three main configurations:- Phono, tape and microphone. All parts are supplied for all three. Its size kept small so to easily fix into existing equipment. The required power supply is ±15 volts which could be obtained from the amplifier voltage rails.

K 5512 $14.95

Calling All Musicians

Check out these professional looking but easy to build DI Boxes. DI Boxes enable you to run long lengths of cable from a microphone, guitar, or any unbalanced equipment to balanced input mixers or amplifiers, with virtually no induced noise. It does this by converting unbalanced lines to balanced.

Quad DI Box Kit

(See EA June '91) The K 5555 allows you to use four separate instruments or microphones. The output of the DI boxes are XLR sockets. This unit also has a 20dB pad switch so you can use a wide variety of different impedance inputs.

K 5555 $79.95

The Single DI Box Kit

(See EA Oct '87) This single DI box is made for rough treatment. The full metal jacket ensures no interference and extends it's life. With professionally printed front panel, your friends wont believe you built it yourself. This DI box has the flexibility of running on a 9V battery or phantom power. It also has a 15dB pad and a unique earthing system.

K 5550 $55.00

Colour TV Pattern Generator Kit

Why Pay $$$ More for an Equivalent Commercial Model??

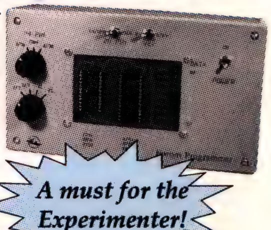
(See SC Nov '91) If you repair TV's or monitors you must have one of these. One of the most important pieces of test equipment for TV service is a test pattern generator. With its seven different test patterns including

• Checkerboard • White raster • Crosshatch • Red raster • Dot • Colour bars • Greyscale. It will enable you to pin point faults saving time and money. As in commercial models this unit also features colour bars and grey scales.

Makes Servicing and Aligning TV Sets Simple. Absolutely Essential for the Serious Serviceperson

K 2710 $115.00

PC Controlled EPROM Programmer Kit



(See EA Sept '93) Have you ever wanted to experiment with EPROM's but never been able to afford the programmer? Then this is the kit for you. It will program EPROM's and EEPROM's from 2716 to 27256 with a read back feature which means you can copy existing EPROM's. The kit as standard comes with the original software listing. For serious users we have specially written Menu Driven Software that will make handling heaps easier. Requires 12V AC 300mA supply.

A must for the Experimenter!

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Ugly is Only Skin Deep!

Stony Broke Speakers by REDBACK

As featured in SC Magazine June '94. This speaker kit is a bit like the Volkswagon; not too pretty to look at but performs superbly. Well that's the same as the Stony Broke speakers; pretty ugly but sounds sensational. Frankly, the reproduction from these speakers must be heard to be believed. They sound simply amazing. Ideal for bookshelf speakers, extension speakers or speakers for personal walkman type systems. Comes supplied in kit form. The kit for each speaker consists of two large jiffy boxes, one C 0629 30 Watt driver, one C 3010 tweeter, crossover, innerbond wadding, port tube, spring loaded terminals, 6 metres of cable, all fixing screws etc. In fact all you will need is a tube of silicon or similar to seal the 2 boxes together. The main speaker holes have been machined, all you will have to do is drill the mounting holes for the speakers. No special tools are required. Basically all you will need is a screwdriver, soldering iron, drill with 3mm drill bit, cutters etc. Even though these are a low cost kit, there has been a considerable amount of engineering to achieve the resultant sound! The main speaker driver complimented with the tuned enclosure exhibits quite amazing bottom end for a speaker this size.

Stony Broke Looks Ugly Sounds Sensational!

"These have no right to sound as good as they do!"
Leo Simpson,
Silicon Chip Magazine.

C 3200 Only $89.95 per pair

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After evaluating 30 or more meters of this calibre we found the Q 1053 to be the best value for money by far!

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With it's ergonomic design, the Micro Jet can be ignited and used simply with one hand. It has an in-built piezo electronic ignition system which ensures easy lighting every time.

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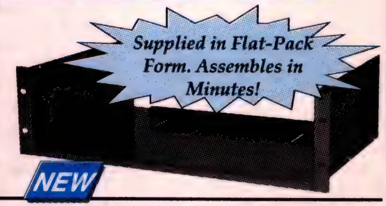

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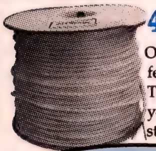

Our supplier has sent us a shipment of this cable with a slight imperfection - sometimes the outer sheath is welded to the inner insulation. This doesn't mean the cable can't be used. The conductors are fine, you just need to strip the insulation off carefully. Each conductor is 14 strands of 0.2mm. Complete 200m roll only at this price.

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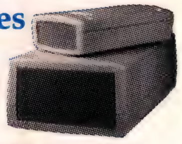

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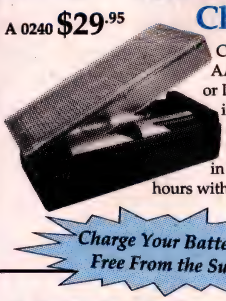
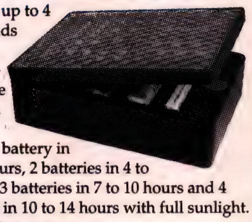


Charges 2 AA, AAA, C or D size batteries at the same time. Will charge in 10 to 14 hours with full sunlight.

Charge Your Batteries Free From the Sun!

AA Solar Charger



Charges up to 4 AA Nicads by simply placing in the sunlight. Will charge 1 battery in 2 to 3 hours, 2 batteries in 4 to 6 hours, 3 batteries in 7 to 10 hours and 4 batteries in 10 to 14 hours with full sunlight.

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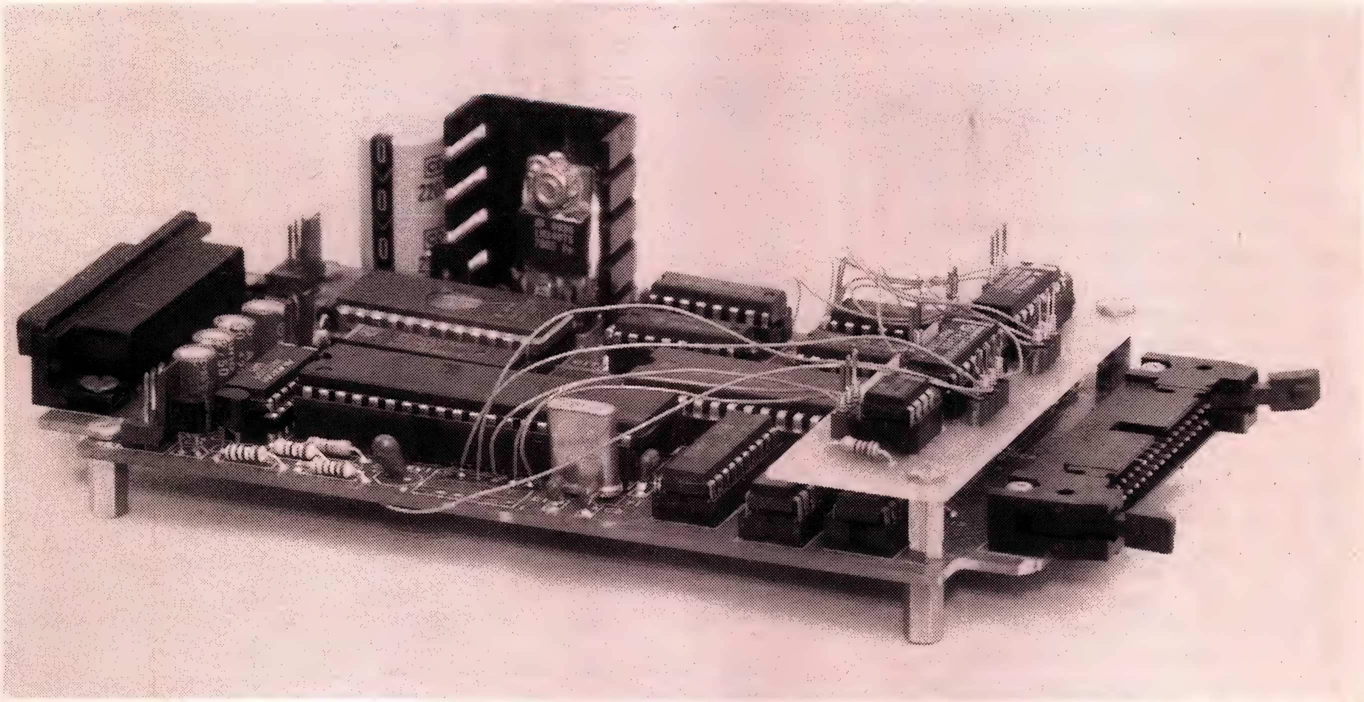


UPGRADE FOR THE ROMLOADER

Is the ROMLoader EPROM Emulator's memory capacity too small for you? Do you write in a high level language and need lots of program memory? Then this ROMLoader upgrade is for you.

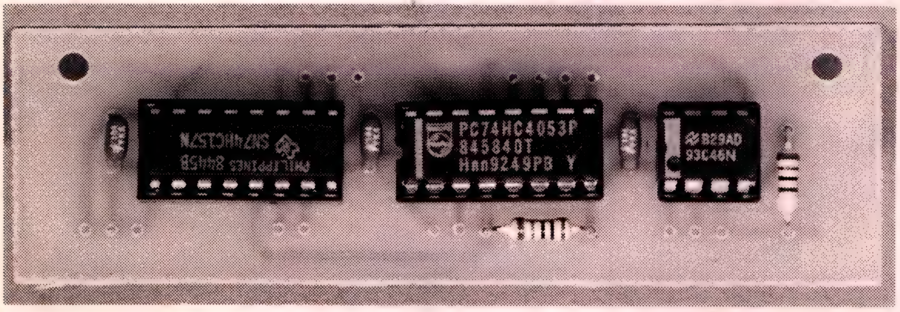
by PETER BAXTER

Ever since the ROMLoader EPROM Emulator project was published in *Electronics Australia* for January/February 1992, I've had people requesting me to enlarge its memory capacity. I've finally done it! (*Editor: There's been a delay in publishing this article, unfortunately, due to limited magazine space...*)

Originally, I thought that most hobbyists wouldn't need more than 64K of memory. I soon found out how wrong I was. There are many people out there writing software in high level languages, which don't compile as efficiently as assembler. There are also people who write damm large assembler programs!

I've now developed an add-on board that allows the ROMLoader to handle 256K EPROMs and SRAMs. 256K is the upper practical limit, as it doesn't require major hardware modifications. What is required is two tracks to be cut, five ICs to be installed and seventeen wire interconnects. I've also been able to install a memory edit feature, as requested by some constructors.

The general operation of the upgraded 'version two' software is basically the



Only three additional ICs are required for the upgrade, and these are mounted on a small auxiliary board as shown here. This mounts above the main board, with leads connecting it into circuit. These are visible in the main picture above.

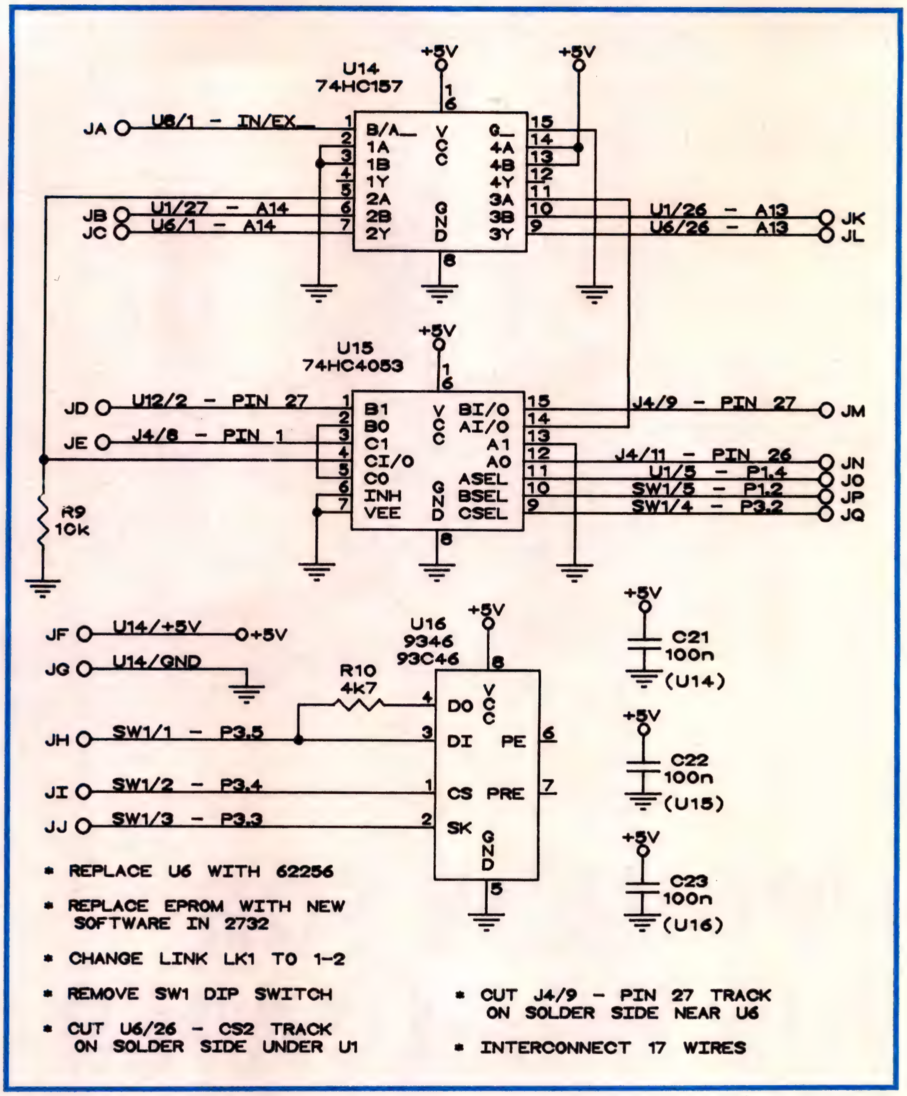
Upgrade for the ROMLoader

same as for version one, except for four items:

1. 'EPROM/SRAM selection' requires you to enter in the type of device you are using — either a 2716, 2732, 2764, 27128, 27256, 6116, 6264 or 62256.
2. 'Number of PAD characters' requires you to enter a number between 0 and F hex, to add padding characters should your display be breaking up. Entering '8' actually means 80 hex, as I multiply the entered number by sixteen.
3. 'Baud rate' now selects between 1200, 4800, 9600, 19,200 and 38,400 baud. While most computers don't indicate that they handle 38,400 baud, I've made it available for when they do.
4. 'Edit memory' is a new feature. Upon typing 'E', the first memory address that you selected last time is read out of the EEPROM and displayed.
   This is convenient if you want to keep changing one location all the time. Entering <Enter> (carriage return) accepts that address and allows you to edit it or select the next sequential address.

To select a new memory address, you must enter all four digits for that new address. There is no back spacing or wrong entry correction, due to me running out of program memory. Just hit escape and start again if you make an error. Changing the data is similar in that you have to enter both digits. While no 'wrong entry correction' might sound a bit primitive, the software does work basically as you might expect.

Just a little warning on edit memory. EEPROMs typically have a life of between 10 thousand and one million writes. Extensive use of this feature may require you to replace the EEPROM after a few years of operation! Also if you enter 38,400 baud and your computer can't handle it, you won't be able to access the menu to change it back to something lower. The solution is to remove the EEPROM, power up the ROMLoader and then plug the EEPROM back in. The ROMLoader will default back to 9600 baud if the EEPROM is missing or incorrect.



- REPLACE U6 WITH 62256
- REPLACE EPROM WITH NEW SOFTWARE IN 2732
- CHANGE LINK LK1 TO 1-2
- REMOVE SW1 DIP SWITCH
- CUT U6/26 – CS2 TRACK ON SOLDER SIDE UNDER U1
- CUT J4/9 – PIN 27 TRACK ON SOLDER SIDE NEAR U6
- INTERCONNECT 17 WIRES

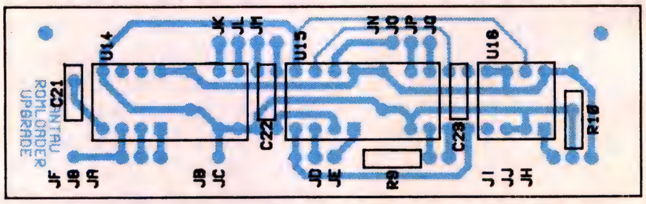
Shown here is the schematic for the additional chips required for the ROMLoader upgrade, plus information on the changes required on the main board.

Circuit description

The DIP switches must be disabled or removed from the main PCB for the upgrade, as more of the 8032's port pins are required. As there are no longer DIP switches, the baud rate, PAD characters and device type selection must be handled differently. The best way is to use an EEPROM, which retains its memory when power is disabled. The 9346 EEPROM is ideal for this.

Two more port lines, P2.5 (A13) and P2.6 (A14) need to be switched between the 8051 and the target system, as they are both upper address lines. U14, a 74HC157 performs this task in the same way that the 74HC157's did on the main board.

Finally, SRAMS and EPROMs have different pinouts so U15, an electronic switch, takes care of this. It simply redirects various pins depending on what device is being emulated.



There are few components required on the piggy back board, but this overlay diagram should make their placement quite clear. The ID codes given for the connection pins are the same as used on the schematic above.

Installation

The PCB is designed to mount on the two spacers near J4 on the main ROMLoader board. I suggest cutting the heads off two 8mm long bolts, to enable you to screw two spacers together with the main PCB in the middle. Hookup wire or thinner wire wrap-wire can be

PARTS AVAILABLE

The author can make available the following parts, to constructors who wish to upgrade their ROMloader:

ROM2 PCB, home made	$10
NMC9346 EEPROM	$5
74HC4053	$2
ROM2 Firmware in 2732	$15
Software on Disk	$20
Post and Packaging	$5

These are all available from Tantau Australia, PO Box 1232, Lane Cove NSW 2066.

Phone (after hours) (02) 878 4715.

UPGRADE PARTS LIST

Semiconductors

U3	2732
U6	62256
U14	74HC157
U15	74HC4053
U16	NMC9346

Resistors

All 1/8W 10%:

R9	10k
R10	4.7k

Capacitors

C21,22,23 0.1uF (0.2")

Miscellaneous

Printed circuit board, 84 x 25mm; 2 x spacers, 10mm long by 3mm thread; thin hookup wire

used to interconnect the connection points to the main board. Follow the directions on the schematic to interconnect the two.

Problems

More than 100 ROMLoaders have been built, and the majority have worked first time. I know, because the constructors rang me to tell me so. It was communication packages they had trouble with!

One constructor encountered a problem which I feel might be worth passing on. He suggested that reducing the value of R6 and R8 to 33k might eliminate any inability to read the SRAM by either the target system or 8032. None of my three prototypes had this problem, but it's good information and worth knowing.

No doubt many of you have discovered that when you connect the ROMLoader up to a target system and turn the target system's power on first, the ROMLoader locks up. The solution is to always turn the ROMLoader on first...

Finally, if your ROMLoader doesn't work, let me know as I may be able to get you going. ❖

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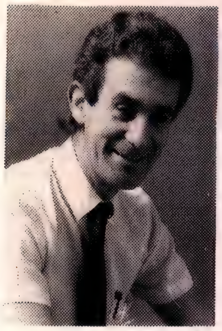
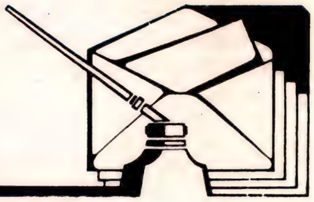


Information centre



Conducted by Peter Phillips

Electricity does funny things!

The RCD (residual current detector) features in three of our letters this month. There's also letters about a TV tube rejuvenator, enquiries on projects old and new, discussion on a What?? question, and more.

Consistent with my comments that this column covers anything, I've opened the proceedings with two conflicting letters about the operation of RCDs. One letter praises the RCD, the other pans it — not because the device is a bad idea, but because it doesn't work!

As you'll read, the official explanation from the RCD manufacturer is along the lines of 'electricity does funny things'. And how often is that one used? I can accept it when the answer doesn't really matter, so long as the offending appliance works. But I'm not sure I'd accept it when my life might depend on it...

I suppose the RCD has caused more discussion in recent times than any other protection device. They're mandatory in new electrical installations, and we are constantly advised to fit one or more to old installations. It makes sense, providing they work as advertised.

An interesting aside though, is that when it comes to safety devices like RCDs, smoke detectors, self-locking pool gates and so on, we the public are remarkably blase. I wonder how many readers have a working smoke detector, RCD protection on all power and lighting circuits and a properly functioning pool gate. Still, I can't talk — though I *have* just fixed the pool gate! Sobering, isn't it?

More on RCDs

The following letter takes up an issue raised in *EA* March 1994, by A.D. (Highett, Vic), concerning RCDs. Recapitulating briefly, our March correspondent wanted information about details of any suitable leakage current testing device we might have developed. This was the result of problems he was experiencing with inductive appliances he thought to be causing false tripping of the RCD protecting the circuit.

I suggested measuring the current in the main earth conductor with a clip-on ammeter, and that inductive appliances were not the reason for the false trips. However, as the following letter points out, it seems the value of the main earth current might not be a good indication as to what's going on in the circuit:

Testing the leakage current with an AC ammeter in an RCD protected radial circuit can be carried out on the individual circuit earth wires, but not on the main earthing conductor. Currents in excess of 5A are not uncommon, and in my installation I have recently measured currents in the range of 50mA to 1500mA, depending on the time of checking.

This current is part of the zero sequence component in the three-phase distribution network, and is predominately third harmonic. (And this subject could fill a whole copy of EA.)

It would seem A.D. has a circuit error or a faulty RCD unit (I doubt). Most likely is an earth connection on the circuit neutral, or a polarity/current reversal on a remote toroid sensor, such as an Email type SDO 21 or similar.

Check testing of RCD operation can be carried out using a 'sparkies' test lamp fitted with a 15W incandescent lamp, which draws about 60mA. An accuracy test can be carried out using a 7.2W lamp (takes 30mA), but such a lamp is not readily available. Clipsal makes an excellent trip test unit, model 486D, but this costs around $350.

AS3000 clause 4.14.9 is quite specific on the application of RCDs to GPO circuits. The exception is a GPO circuit supplying a refrigerator or freezer, but here the GPOs must be positioned so that other portable appliances cannot be plugged in to them. The reason is to prevent food spoilage due to a prolonged power failure, caused by another appliance tripping the RCD.

While some spurious tripping problems occurred with earlier type RCDs, generally from harmonics produced by transistors, thyristors and rectifiers in power supply circuits, most manufacturers have long since overcome these problems with harmonic filters. Nuisance tripping today is usually caused by incorrect installation, and often a neutral-earth connection. (D.G., Cormandel Valley SA).

I've cut D.G.'s letter short, as I want you to read the next letter. Then I'll let D.G. finish...

Concerning RCDs, I feel you should be aware that a simple test of current flowing in the earth wire is not indicative of leakage current that the RCD measures.

In my house we have fitted an RCD to the power circuit, but as the lighting circuit has a 600mA leakage to earth, it is not RCD protected. The lighting circuit will be upgraded as funds permit, but in the meantime the RCD on the power circuit is not affected by the 600mA earth current.

As an aside story, we had no end of trouble when the RCD was installed. The device would not trip, even when the test button was pressed, and the manufacturer sent two representatives with appropriate test gear to find out why. After several days of investigation, with no answer forthcoming, the device decided to operate correctly. The manufacturer's explanation was 'electricity does funny things.'

However I have since had two severe electrical shocks that have not caused the RCD to trip. The manufacturer says I was not hanging on to the mains for the time (30ms) required to trip the RCD. I notice that their advertising has been changed from 'trips instantly' to 'in less than 30ms.'

I am 48 years old, and have been in the electrical and electronic field all my life. I know what a bad shock is, having had a few in my time. If the RCD manufacturer is adamant that the recent shocks I've had are acceptable, then they are just waiting for their first court case. After all, I even got a small burn at the point of contact.

I am not at all confident the device we have installed is all it's claimed to be, and I would challenge a representative from the manufacturer to come to my home and hold the active wire. (J.E., Woodville SA).

Wow! But before I comment, here's the rest of D.G's letter...

I have experienced no problems with four Clipsal type 4EBE 220/30 RCDs on resistive, inductive (welder and motor), and simulated capacitor loads. One is fitted as mains protection in my caravan, and is quite stable and responsive on both a 240V mains supply and from a 12V/240V inverter. The lights in the van are all fluorescent.

Nor can I recall any problems with the many three-phase units I have been involved in design/commissioning in industry. (D.G.)

Taking the first point, obviously testing the earth current in the main earthing conductor can only be useful if all other circuits are isolated, other than the circuit under test. I suggested the main earth conductor as it's usually accessible.

Obviously this conductor carries the leakage currents from all circuits, including, as D.G. points out, the harmonic currents produced by a three-phase system. So if you can't isolate the other circuits connected to the main earth, I agree that a better and more reliable test is to measure the individual earth wire currents.

But of more concern is J.E.'s story about the RCD in his power installation. Most of us have experienced a time when the only explanation is 'electricity does funny things', but when it comes to a lifesaving device, one is entitled to a better reason for it behaving strangely.

I've purposely not mentioned the name of the RCD manufacturer, as it will serve no point and might result in legal ramifications.

I'm aware of people alleging to have received a severe shock from an RCD-protected GPO. But I also know of several people who have tested their RCD by hanging on to the active. Their reports vary from 'I didn't feel a thing' to 'that hurt quite a bit.'

In my opinion J.E., you have a problem either with the RCD or with the installation. I think it would take more than 30ms (or 1.5 cycles) to get a burn from an electric shock, but as D.G. has pointed out, the installation might be the problem. But, a problem there certainly seems to be!

Fluoro lights

Staying with electrical matters, the next letter has another reason why the ballast in a fluorescent light fitting should be in the neutral side. You might recall I asked this as a What?? question in October '93. The answer was that if the ballast develops a fault to earth, it will blow the filaments in the tube, rather than the main fuse. This won't affect the other lights in the circuit.

A ballast should be on the neutral side of the circuit, as if it is connected in the active side, a fault downstream of the ballast (which includes most of the light circuit), may go undetected. If there's a short to earth, or a fault between active and neutral, the inductive reactance of the ballast will limit the fault current to a few hundred milliamps. This will not blow a fuse, and the fault current will continue to flow.

In the case of an earth fault, and if an RCD is fitted, the breaker will trip, leaving an obscure little puzzle for the electrician to unravel. If the earth wiring is disconnected or high resistance, the fault could even be dangerous.

This leads one to question whether light dimmers and speed controls on power tools and appliances should be in the neutral side. (J.W., Waterman WA).

There's a lot of sense in this, J.W., and you have given many more reasons to connect the ballast in the neutral. Yet I wonder how many fluoro light fittings have been incorrectly wired, just waiting to cause the problems you mention. Now we get more electronic...

TV tube rejuvenator

A common belief is that a TV picture tube rejuvenator is a simple device to design and build. I don't agree, unlike our next writer...

I am enquiring about the circuit diagram of a TV picture tube rejuvenator. These devices are used to reboost the guns of a picture tube that has lost its brightness.

A high DC voltage is applied between the heater and cathode of the tube, which blasts the coating (barium oxide) from the cathode. (A.S. Bankstown NSW).

I agree that the operating principle of a CRT rejuvenator is to remove contamination from the cathode, but I don't consider this to be a trivial exercise. Commercial rejuvenators cost $700 or more, and contain quite a lot of circuitry to prevent the device destroying a tube.

The variables to be considered are how long to apply the excess voltage, how hot to get the filament, the amplitude of the 'cleaning' voltage and so on. This is done on a commercial unit by measuring the emission current.

For this reason, we have never presented a design for a tube rejuvenator. A method I confess to using is to heat the 6.3V filament(s) with an isolated voltage of 8V or more for a minute or so. Then when the cathode is really hot, you switch on the TV set and the EHT anode voltage 'sucks' the contamination off the overheated cathode.

WES Components stock a tube rejuvenator for around $799. Their phone number is (02) 797 9866.

Dual-ganged pots

The next letter asks two questions, one we can help with, the other I can only throw over to the readership. The first query is about the Low Cost Sine/square wave Oscillator, published in March 1992.

My first enquiry concerns the name of a supplier for a reasonably closely matched, 50k ohm dual-ganged potentiometer as used in your sine/square oscillator. The one supplied in the kit has a total resistance of 46.2k, and as the article mentions, the 'vagaries' of the pot put the front panel frequency markings out.

My second question is of a more unusual nature and is about the formula given for the VA rating of a transformer as given in an earlier column of yours. The formula is: area (in sq inches) equals the square root of the VA rating divided by 5.58. It is very accurate for normal EI transformers (so I've learned), but it doesn't seem to apply to C-core transformers wound on both legs and double C-cores wound on one leg of each C. Any thoughts? (J.O., Blackheath NSW).

First to the potentiometer. While I can't testify personally to the accuracy and tolerance of their dual 50k pots, I suggest you try contacting ME Technologies of Dyers Crossing, who advertise regularly in the magazine. Their phone number is (065) 50 2200, or fax (065) 50 2341. You could also try either Farnell Electronic Components, of 72 Ferndell Street, Chester Hill, 2162, phone (02) 645 8888, or RS Components. The latter has branches in most states, and the Sydney branch can be phoned on (02) 669 3666. Although the parts from these suppliers are a tad dearer than others, the quality may be better.

Regarding the formula to find the VA rating of a C-core transformer, perhaps a reader might be able to help, as none of my literature has this information.

February What??

I was waiting for a letter like this one:

I always look forward to reading your articles in EA and enjoy the electronic challenges you present in What?? However I must protest at the answer to February's What?? question, given in the March issue.

You have assumed that the meter has zero resistance and this is simply not legitimate. In the interests of mathematical integrity, I have calculated an equation giving the meter current in amperes, in terms of R ohms (the meter resistance) and the parameters as given in the question. This equation simplifies to $Ia\text{-}b = 160/(16000 + 33R)$ *amperes.*

If R is zero as you assumed, this current would indeed be 10mA as in your answer. If R is greater than zero, the current will be some lesser value. Two examples illustrate this, based on standard MU65 type meters:

1. *A 20mA meter using a 100uA movement having an internal resistance of 3500 ohms, would, with its shunt in parallel present a resistance of 17.5 ohms.*
2. *A 20mA meter using a 1mA movement having an internal resistance of 200 ohms, would, with its shunt in parallel present a resistance of 10 ohms.*

If these values for R are inserted into the equation, we see that the first meter would pass 9.652mA and the second 9.798mA. (D.O., Montmorency Vic).

Fair enough, D.O. You're right of course, as there is no such thing as an ammeter without resistance. I wonder though if your 'real' analog ammeter has a resolution to three decimal places!

PCB inductor

I know I *had* the information that would help our next correspondent, but I'm blowed if I can find it...

I am an avid reader of your magazine, but so far I haven't had the nerve to actually construct any projects. My current interest is in UHF remote controls and I've noticed that all the designs published in EA have one of the inductors (the antenna?) etched on the board.

The project I intend constructing will have various remotes, where one will have two channels and another 32 channels, using a function switch to alter the transmitted data. Therefore, the one PCB design will not suit all purposes.

Oatley Electronics have advised they can supply the receiver module separately, but don't have the specifications of the etched inductor. Could you please advise particulars of that inductor (L1) so that I would be free to design my own custom PCB. (W.T., Bayswater Vic).

I certainly had an equation or a design procedure to calculate the inductance for an etched PCB coil, but as I mentioned earlier I can no longer find it. However, regardless of design tools, I'm sure Oatley Electronics would have spent many hours, and PCB patterns, to perfect the coil on their transmitter PCB. I don't know the inductance of the coil (yes, it's the antenna), and I can't be of any more help.

Still, although your transmitters will have a different front end, the actual transmitter will be the same, so the coil design for one should apply to them all. Therefore, experimenting until you get it right will not be so arduous. Also, a transmitter from Oatley Electronics won't cost you much, and you might be able to integrate it with your design.

1GHz counter

The next letter asks about the 1GHz Frequency Counter published in the April 1993 edition.

I have assembled the 1GHz frequency counter and I congratulate you on an extremely well presented kit and instructions. The unit worked from the first switch on, and I calibrated the lower ranges from WWV and two crystal oscillators I use in the ham shack. Calibration was easy and accurate.

However, the 1GHz range will not calibrate. It measures frequencies in the two metre range (144MHz and beyond) quite accurately, but with the least significant digit being one or two higher than it should be. But the calibration pot makes no difference to the reading. Can you help? (R.F., Bayswater Vic).

The potentiometer is not for calibration, R.F., it's to optimise the sensitivity for the 1GHz range. The only calibration adjustment is the trimmer capacitor CV1. This capacitor calibrates *all* the ranges, not just the lower ones. An error of a couple of units in the least significant digit is easily caused by switching variations in a digital counter, and is present in even the most expensive models.

Active crossover

And another project enquiry...

After reading the article on Active Crossovers for speaker systems (May 1992), I built a pair. My aim was to use my transistor amplifier for the bass region, and my valve amplifier for the midrange and treble (I have a pair of Klipschorn three-way speakers).

I chose the Bessel filter and calculated resistor values for a crossover region of 450Hz, as this is the crossover point in the passive network. The values I calculated are: R2 and R4 = 180k, R5-R7 = 220k, R8-R10 = 20k.

Without having the necessary test equipment, I took the risk of letting my ears be the judge. The bass and midrange seem to be handling more than necessary, and there's some distortion. I've double-checked the components and connections, and everything seems to be in order. Could you tell me if my calculations are wrong, or whether this crossover is not suitable at this frequency. (B.B., Milperra NSW).

This is a difficult one to answer. The author of the project is not easily contacted, so we can only theorise in the absence of actual tests. Certainly your crossover frequency is giving resistor values that are some 10 times higher than those used in the article, but I rather doubt this is a problem. I haven't checked your mathematics, so I can't comment on your resistor values.

You mention distortion, which suggests a DC shift in the outputs of the op-amps, or even a power supply fault. Measure the DC output voltage of each op-amp, and confirm it's pretty close to zero. If not, perhaps your resistor values are too high for the circuit to work properly. Also confirm that the power supply voltages are present, and correct at all op-amps.

Finally, try checking the input signal level; perhaps you are overloading the filter.

Magnavox 8-30's

Remaining with audio, we now take a little trip into the past.

Years ago I constructed your 3-45L loudspeaker enclosure project and have been pleased ever since with the sound. However a few months ago, one of the Magnavox 8-30 speakers *stopped working. As this speaker and the subsequent 8MV are no longer manufactured, I am in a dilemma as to a possible replacement.*

Can you recommend an alternative speaker, or explain the technical specifications pertaining to loudspeakers which should be considered when substituting a speaker. My enclosures are still in excellent condition and don't deserve to be thrown on the scrap heap. As my amplifier can deliver up to 43W RMS per channel, the substitute speakers should be able to handle this power level. (I.R., Yokine WA).

The Magnavox 8-30 was introduced around 1970, and was a speaker somewhat ahead of its time. In 1971, an 8-30 cost around $26, and was rated at 30W.

Regarding a replacement, back in the 1970's the main parameters quoted were sensitivity, free-air resonance, frequency response and, of course, physical size. The nominal resonance of the 8-30 is 45Hz, and the frequency range is from 40Hz to 8kHz. There were apparently three versions of the 8-30, having minimum impedance values of 4, 8 and 15 ohms at 350Hz. The sensitivity is given as 'about average' according to standards of the day.

The author(s) of the original article in January 1971 describing the system have this to say about a substitute speaker:

Having read the foregoing article, readers may well be prompted to ask whether the enclosures described above could be used with some other 8-inch loudspeaker. In fact, the enclosure designs inter-relate with the characteristics of the 8-30 loudspeaker, and performance over the bass register will only be as represented with an 8-30 driver or with some other loudspeaker (if there is one) which has similar parameters affecting low frequency characteristics. Other 8-inch loudspeakers will 'work' in the enclosures, but only in the sense that a reasonable enclosure is better than none at all. A random combination might even work quite well, but as a matter of good fortune rather than good management.

However, as you still have one 8-30 in working condition, an option would be to actually measure the important parameters of this speaker in today's terms.

These include parameters such as Vas (equivalent volume acoustic suspension), Qts (total Q) and so on. These terms sound rather esoteric, but can be measured by the hobbyist using basic equipment. You could then use the measured parameters to pick a substitute.

We don't have space here to explain in detail, but a book called *The Loudspeaker Design Cookbook* by Vance Dickason is an excellent, easy-to-read reference on how to go about this. The latest edition is available from ME Technologies, PO Box 50, Dyers Crossing 2429; phone (065) 50 2200.

So, I.R., I've given you as much information as I can find, and it may be that a suitable replacement is available. Good luck!

Electroplating

We have had a few enquiries like the following...

I would like a back copy/photocopy of EA with an article about electroplating. The article describes a hobby method and chemicals used to plate small components. (G.C., Drysdale Vic).

While we normally draw the line at articles or projects over five years old, I'm including this letter as quite a few readers might be interested.

The only article we have ever done on electroplating was one by Jim Rowe, in August 1965. While back copies are impossible, we can still provide photocopies of the article at the usual rate, as described on the last page of the magazine.

What??

I'm running short (again) of mathematical questions, so I'll ask a Why?? instead. The question comes from Mr J. Watson, of Waterman WA, and although he is not sure that his answer is correct, the question is thought provoking and the answer logical.

Here's the question:

The sensitivity of the human eye to lights of various colours is much lower for blue, compared to green/yellow. A response curve shows a sensitivity of about 0.3 for blue, compared to 1 for green. So why do the police use blue as an emergency warning colour, if the human eye doesn't show a marked response to this colour?

Answer to May's What??

Not an easy problem! The answers are:

minimum resistance = 2.4 ohms (2388.357243563846 milliohms) and the optimum path length AXYB is 2159 metres (2159.05331827638 metres). Refer to Fig.1.

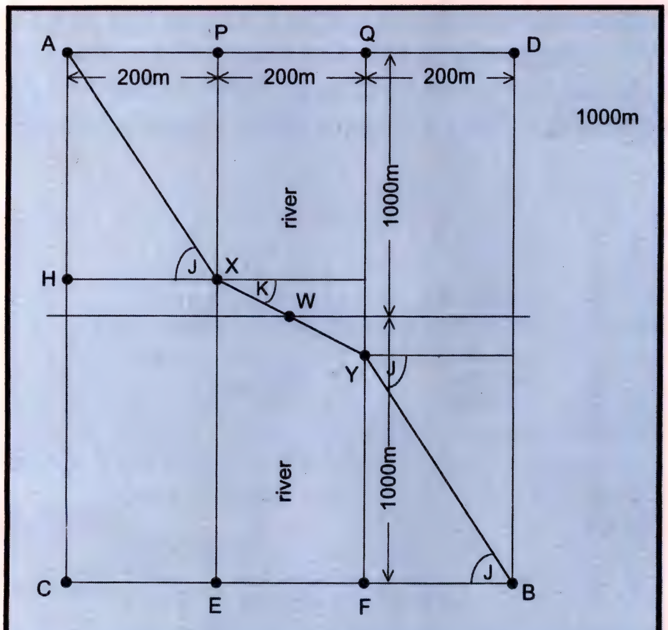


Fig.1

The problem reduces to finding length PX. Then by symmetry FY = PX and AX = BY. Also, by reciprocity, all possible paths must go through a central point called W.

Because the resistance of the submarine cable = 2 x (resistance of the underground cable) it follows that sin J = 2 x sin K (Snell's law or Fermat's principle).

To solve call:

remainder (which we want to be zero)
= [sin J - (2sin K)].

$\sin J = PX/AX = PX/\sqrt{(PX^2 + 2002)}$

$\sin K = ZY/XY = (2000 - 2PX)/\sqrt{[(2000 - 2PX)^2 + 2002]}$

Then try some values for PX and for each remainder search for a value of PX that makes the remainder as close as possible to zero. You'll find that if PX = 9453.919053698605, the remainder is less than 5×10^{-15}, which is the limit of resolution of a double precision computer program. Thus AX = BY = 964.874696m and XY = 229.303925286m.

Incidentally this is nearly 71 metres longer than a straight line path, but has 428 milliohms less resistance. ❖

Vintage Radio

by PETER LANKSHEAR

Repairing moving-coil loudspeakers

Considering that their construction includes a fragile material like paper, moving coil speakers are remarkably durable. But faults and damage can occur, and this month we will discuss some of these and how you can deal with them. Please note though, that I do NOT recommend attempting repairs to expensive high quality speakers. These require skilled treatment, and their repair should be left to specialists.

It is an interesting exercise to study the changes in speaker construction methods over the years. In most cases, the older the speaker, the more readily it can be dismantled. Early models, typified by the Kolster Brandes unit in Fig.1, were assembled with nuts and bolts. As time went by, and especially after the demise of the electromagnetic speaker, more and more of the assembly was pressed, glued and welded — until with today's speakers, anything but simple cone repairing is practically impossible.

Many receivers were fitted with speakers from well known international firms such as Rola, Magnavox and Celestion. Frequently though, radio manufacturers, especially the larger ones, made their own speakers, or used unbranded models. Even here, however, it is often possible to find a replacement.

It is very desirable to have the original speaker in a receiver, or at least a similar model, but it is not uncommon for a receiver at some time to have had a substitute fitted in place of its original speaker. Sometimes this is is all too evident. To find a modern permanent magnet speaker, perhaps with the original output transformer screwed to the side of the cabinet is, even to a beginner, an obvious anachronism. However, a contemporary replacement may have been made many years previously.

There was only a degree of standardisation of sizes and specifications, and it is often difficult to be completely certain about originality. Furthermore, set makers often changed speaker brands with changes in models, or had more than one source.

Sorting out speaker authenticity is typical of the research that can make the radio historian's life so interesting. Comparing notes with other collectors may well answer some questions. Some detective work, using clues like brand names and field resistance compared with the original, can be used as a check. If the replacement has the same specifications as the original and is of a similar age, a substitution is not too disastrous.

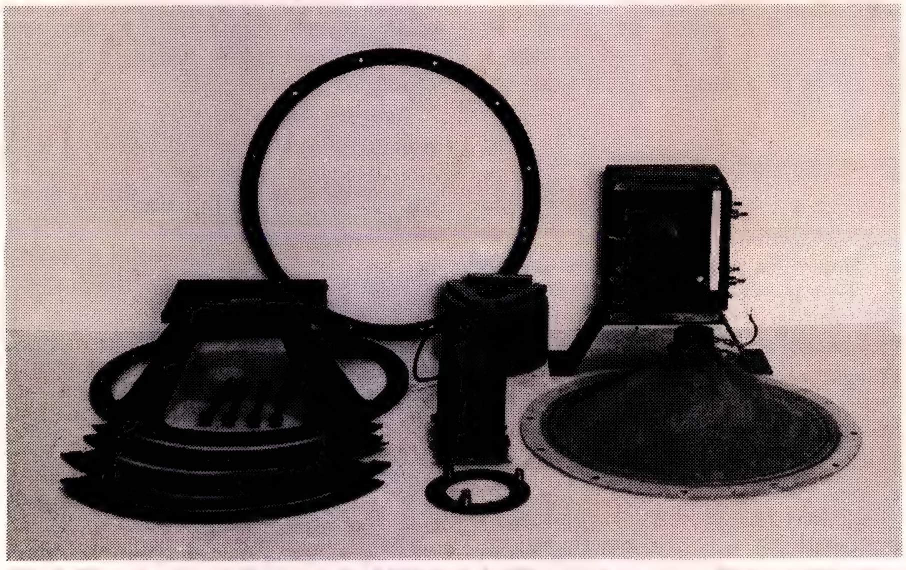


Fig.1: The component parts of a 1930 Kolster Brandes speaker. The construction is typical of early models, which are easily taken apart for repairs — unlike more modern models. This model has no hum-bucking coil or shading ring.

Careful handling

A speaker undisturbed and in a dry clean environment can remain in good condition almost indefinitely, but damage and deterioration can occur in various ways. Most vulnerable is the cone, and a common source of damage is careless handling. Using one hand to pick up a speaker by the rim has resulted in the tearing of many cones. The heavy magnet causes the speaker to tilt, and then fingers go through the edge of the cone. Always make it a rule to pick up a speaker by the magnet, or use two hands...

It is also easy to damage a cone with a misplaced screwdriver being used on mounting screws. This is especially so with older permanent magnet speakers with large external fields, which can provide considerable force to drag a screwdriver in an unexpected direction.

Speaker cones sometimes attract undesirable attention from children, with pencils and nails being poked through grill openings. Generally such damage does not effect performance significantly, but it does little for the cone's appearance.

All too often, a fine old receiver will be found to have hosted a colony of mice. For some reason, rodents find radios irresistible locations for setting up house, causing considerable damage from corrosion and gnawing, and there seems to be a premium on shredded speaker cones as nesting material.

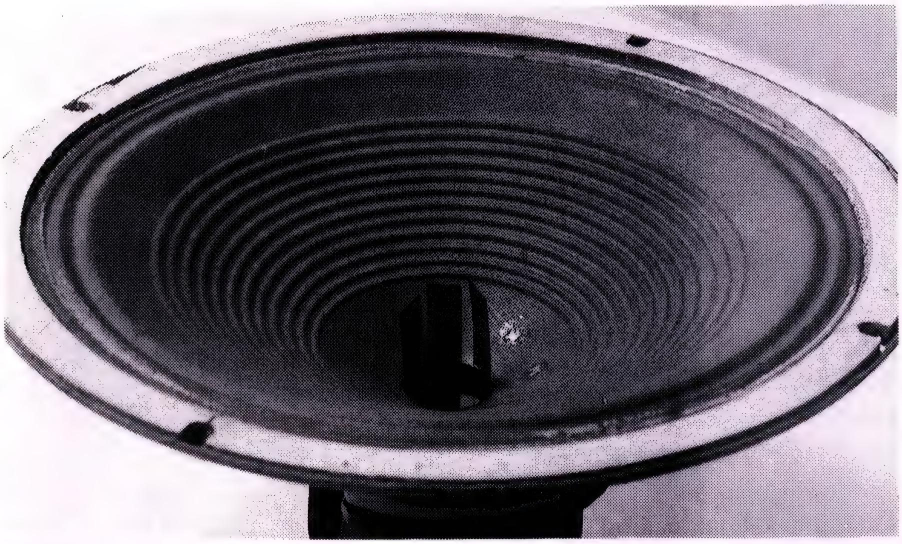


Fig.2: Centring of the voice coil is assisted by using three shims in the gap. Thin card can be used, but strips of photographic film are better. Missing sections of corrugated cones like this example can be difficult to patch.

Cone repairs

At one time, some receiver manufacturers stocked spare cones. Some of the major speaker makers, Rola being one, even provided a reconing service. For a modest fee, a new cone with voice coil could be factory fitted to many models, and the speaker returned as good as new. Today we have no option but to attempt our own repairs, for even if speakers were still made locally, to provide such a service would be quite uneconomic.

Simple tears and holes can be repaired without dismantling the speaker. Provided that all the pieces of the cone are still present, the edges can be reglued — but the adhesive should be flexible.

Cellulose cement was used traditionally for fixing the cone and gasket to the speaker frame and can still be used for this purpose. It also used to be recommended for cone repairs, but as it becomes very brittle it can cause buzzing noises. The rubber-based contact adhesives available today are ideal. A thin line of glue along the torn edges will usually suffice, but small patches of thin paper for reinforcement may sometimes be necessary.

Although its convenience may be tempting, *never* use cellulose tape! The adhesive eventually hardens and separates from the tape, leaving an unsightly mark and a failed repair. Incidently, it should also never be used to repair old books or magazines, for the same reason.

Occasionally, there will be small radial tears at the edge of the cone and in the surround. These can occur naturally, and as they don't normally affect the speaker's performance, they can generally be ignored.

A cone that has a large section missing obviously cannot be repaired simply by gluing the remnants together. In this case patches of paper of a similar texture can be used. Artists' black paper is often suitable. However some cones are moulded with a series of corrugations, as in Fig.2, and these are very difficult to patch.

Cones are traditionally black in colour, although there have been other shades. If the speaker has had prolonged exposure to strong light, the cone colour will often have faded and the paper may have become brittle. One way of sprucing it up, and to disguise repairs is to paint on a light coating of automotive tyre black. This is thin enough to penetrate the pores of a cone, and it also seems to have a small content of a rubbery compound which provides a useful degree of revitalisation of brittle fibres.

Corrugated surrounds can be difficult to repair if damage is extensive. Some early speakers had thin leather or fabric surrounds, which are much easier to repair or renew. If there is significant damage, or perishing, the best approach is to first dismantle the speaker and separate the surround from the cone, after saturating the junction with lacquer thinners to soften the cement. Then, with the new surround cut out and lying flat on the table, it can be glued to the cone.

Voice coil problems

A common problem with voice coils is 'poling', or rubbing against a pole piece. Clearances are very small and there is little tolerance for the coil being off-centre. In the case of modern speakers, with permanently fixed spiders, there is little that can be done. However many older speakers have adjustable spiders, and recentring can be straightforward. Speakers with front spiders are the easiest of all to deal with.

The method used for both types is shown in Fig.2. With the spider adjustment screws loosened off, three equally spaced shims are inserted between the voice coil and the centre pole of the magnet. Heavy paper is usually about the right thickness and is often used for shim material, but a better material is photographic film cut into strips about 5mm wide. With the shims in position, retighten the spider adjusting screws.

Sometimes there will be a small dome at the centre of the cone to keep dust out, which will have to be removed first. A careful application of lacquer thinners may help in loosening any cement, but care must be taken not to loosen or detach the voice coil in the process.

If recentring the cone does not cure the voice coil rubbing, the coil former may be distorted, there may be iron filings in the gap or a knock may have shifted the centre pole piece off centre. To proceed further, the cone will have to be removed.

In the case of very old speakers, as in Fig.1, it is fastened to the rim by a clamping ring. In later speakers, the surround will be cemented under a cardboard or felt gasket. The cement may well be easily loosened, but otherwise lacquer thinners should be applied and left for a few minutes. Disconnect the flexible voice coil leads and the spider mounting and carefully lift the cone out.

If the pole pieces require repositioning or reassembling after dismantling, adjustment is simplified by the method shown in Fig.3. After loosening the appropriate screw(s), three nails — or better still, twist drills — of the correct diameter are positioned in the gap and the bolts tightened up again.

A warning: NEVER SEPARATE THE MAGNET AND POLE PIECES OF A PERMANENT MAGNET SPEAKER. Normally, it is unnecessary and to do so may cause serious demagnetisation. If filings or dirt have strayed into the gap, a steel knife blade or blue tack is useful in their removal.

With the very tight gap clearances, a voice coil needs only to be slightly distorted to rub on the pole pieces. The usual method of reshaping is to gently push in a cork of the right diameter, and then apply a thin coating of polyurethane lacquer.

An annoying fuzziness or buzzing, especially noticeable at low sound levels, may come from loose turns on the voice coil. Again, a thin coating of lacquer should be applied. This fault is sufficiently common that it is a good precaution to give this treatment automatically to any speaker that has been dismantled.

Another voice coil fault can create puzzling symptoms. The speaker seems to be 'dead', with the voice coil apparently open circuited. In some instances, some momentary life can be restored by flexing the cone.

This problem is caused by poor soldering at the eyelets where the voice coil wire is terminated, but considerable care is needed to correct the problem. The connection will have been coated with lacquer or cement, and it is very easy to overheat the eyelets with the soldering iron and burn a hole in the cone. The best method is to carefully scrape the metal as clean as possible and then resolder with a low wattage iron, as quickly as possible.

Field windings

An essential part of an EM speaker is the field winding. One problem to always be on the lookout for is the possibility of a replacement speaker having a field of the wrong resistance. Too low a resistance and the high tension voltage applied to the valves will be too high, and it follows that with a higher than normal resistance, the reverse can apply.

Field windings are — fortunately — reasonably trouble free, but they can become open circuited. This is invariably due to the same 'green spotting' that afflicts audio transformers, and the cause is the same: acid in the paper bobbin attacking the copper wire.

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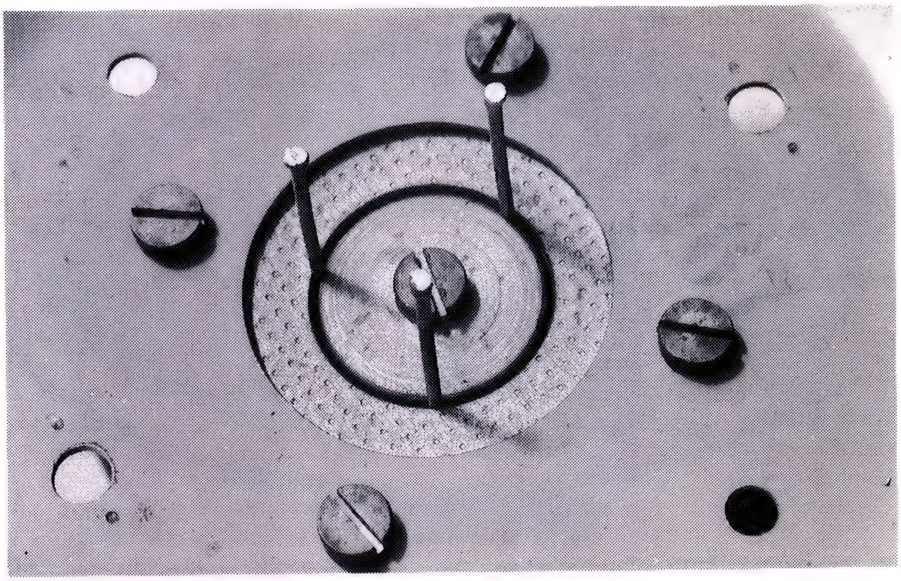

Fig.3: When re-assembling a speaker electromagnet, it's essential that the gap be accurately centred. Three nails of the right size can be used to hold the assembly in position while the bolts are tightened.

If a field winding is found to have no continuity, it is worthwhile attempting a repair. Dismantle the speaker and carefully remove the field winding, noting the position of the hum-bucking coil. The winding may be a tight fit on the pole piece. If so, heating the assembly by leaving it on an oil-filled radiator for a while may help.

Most field winding bobbins are made of quite thin card and it is usually possible to gently peel them back sufficiently to look for green spots. These may be no bigger than a pinhead, and sometimes will leave a tell-tale mark on the bobbin. The wire ends can often be rejoined, soldered and insulated from the rest of the winding with a thin piece of tape. It is a good idea to saturate the bobbin cheeks and core with thin varnish or shellac, as a precaution against further trouble.

If the break cannot be found, or the bobbin is solid, the wire can of course be unwound until the break is found. In this case it's best to completely unwind the wire and immerse the bobbin in hot paraffin wax...

About 10 years ago, I did this with a 1930 Majestic G3 speaker that had been unused for many years, and it turned out to be a memorable task. Using a lathe I unwound the 7km of wire, to find no less than 15 breaks! After soaking the bobbin in hot wax, the field was rewound, and at last report, the speaker was still performing well. I might add that most fields do not have such daunting lengths of wire, although I would hesitate rewinding without some sort of winding aid.

When reassembling the speaker, remember to get the hum-bucking coil round the right way, or the effect will be to *add* to the hum. If this happens, rather than dismanting the speaker, simply reverse the connections to the hum-bucking coil.

Apart from physical damage, usually from dropping, or corrosion, speaker chassis do not give much trouble. Be cautious, though. If the mounting screws are not tightened up carefully, it is possible to create chassis distortion, putting the voice coil out of alignment. Always tighten the screws in diagonal sequence, a turn at a time.

Societies: a reminder

Lately I have received a number of requests for data on specific items of equipment; but unfortunately, I have not always been able to help. I would remind readers that advice, and sharing of information, circuits and data is one of the major aims and functions of the two vintage radio societies operating in Australia and New Zealand.

Of course there are other benefits of joining these societies, such as receiving their magazines, published quarterly. As well as having interesting articles on all manner of topics, these also feature buy, sell and swap columns. The annual membership fee of each society is only $15. In high membership areas, both have local branches meeting regularly.

The Membership Secretary for the Historical Radio Society of Australia is J.R. Wales, of PO Box 283, Mount Waverley, Victoria 3149. Similarly membership applications to the New Zealand Vintage Radio Society should be made to Bryan Marsh, 20 Rimu Road, Mangere Bridge, Auckland 1701. Why not join one — or even both. ❖

Screen saver

Continued from page 66

the tolerance of the timer circuit components. Depending on the setting of J2, you will either get a permanently blank screen or one that flashes off and on.

Pressing any key on the keyboard should bring the screen back to normal, but the unit does not trap this key press. So whatever application you are in will accept this keystroke and act upon it. This can sometimes lead to an unwanted operation, such as a delete!

The best key to press to bring the screen back is either the <Shift> or <Ctrl> keys, because most programs don't accept a single press of these keys.

You can now have confidence that you can leave your PC on for any length of time, running any application you like, without worrying about wearing out your expensive monitor.

If it doesn't work

The first thing to do when anything doesn't work is to blame Murphy's Law. Cursing, swearing and throwing the thing across the room might also make you feel better, but it doesn't usually fix the trouble. If the keyboard does not work, then it is possible that the fuse has blown in the PC. This is usually a little Pico fuse, rated for a few hundred milliamps, which is soldered to the board — it looks similar to a resistor. Its job is to protect the motherboard from people like us who like to hook gadgets up to the keyboard port. If the fuse *has* blown, then your screen saver device could be hooked up backwards or something dumb like that.

PARTS LIST

Resistors

R1	22k 1/4W
R2	820k 1/4W
R3	220 ohms 1/4W
RP1	8 x 1k SIL resistor array

Capacitors

C1,2	10uF 16VW TAG tantalum
C3	0.1uF MKT or metallised polyester

Semiconductors

IC1	7555 timer
IC2	4040 binary counter
IC3	4011 quad NAND gate

Miscellaneous

PCB, 74 x 48mm; plastic jiffy box, UB5 (83 x 54 x 28mm); 16 x PCB terminal pins; 1 x 4-way length of SIL pin header strip; 1 x 26-way IDC card edge connector; connector for keyboard port interfacing; hookup wire, etc.

If there is no picture on the display when you connect the IDC connector, then there could be a short somewhere on the IDC connector, or the blanking line could be permanently tied low for some reason.

If the PC operates normally, but the screen doesn't blank out, then first check pin 2 of IC3 for the 0.1Hz clock signal. Next check that pin 11 of IC2 gets some positive pulses when a key is pressed.

If pin 11 of IC3d is going low after the time period you've set, then the project is working — try shorting out R3. If the screen blanks with a colour other than black, or random garbage appears, then the value of RP1 may be too high.

If all these suggestions don't fix the problem, then take the unit out of the computer and get it working on the bench before you try again.

If it still doesn't work, you may have a VGA card that works differently for some reason. In which case you'll need to check the manual for the card, which should contain information on its feature connector.

Good luck! ◆

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P.O. Box 199,
Alexandria, NSW 2015

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

June 1944

BC stations for troops: Recently, several new stations have been set up in the Pacific area. Operating on the normal broadcast band they are intended to bring entertainment to the fighting men of the United Nations.

Recorded bands: Sound recorded on motion picture film is now being used by the Royal Canadian Air Force to supply band music. One sound truck for each of the 32 air training stations, now supply the music for route marches, ceremonial parades and drill ground training. The Central Band of the RCAF recorded a series of marches on 16mm film at the Associated Screen Studios in Montreal.

45 minutes of continuous music was recorded on each reel of film.

June 1969

Colour TV committee: The Australian Broadcasting Control Board has circulated draft PAL colour television system standards to the industry, and has held a meeting in Melbourne with industry representatives to discuss the standards.

The meeting decided to set up a committee to make recommendations on standards for radiated signals, required transmission tests, and detailed equipment standards. The committee will deal with transmitters, receivers, relays, and studio equipment respectively.

Coaxial cable link: A 603 mile coaxial cable system was recently completed between Perth, Geraldton and Carnarvon. The $7 million link is part of the planned development of an Australia-wide broadband telecommunications trunk network. Special equipment was used to bury the cable directly to a depth of four feet without the use of trench excavating machines.

The largest stage of the Australian network, a microwave radio link of 1440 miles skirting the Nullarbor Plain from Port Pirie to Northam, is still under construction.

When this link is completed later this year, a broadband network will run from Cairns through all mainland capitals to Carnarvon with spurs to Tasmania and many provincial centres.

Television service: The Australian Broadcasting Commercial Board recently made recommendations to the Postmaster-General regarding the extension of television services to other centres in addition to those already approved (Kalgoorlie, Geraldton, Renmark, Mount Isa and Darwin).

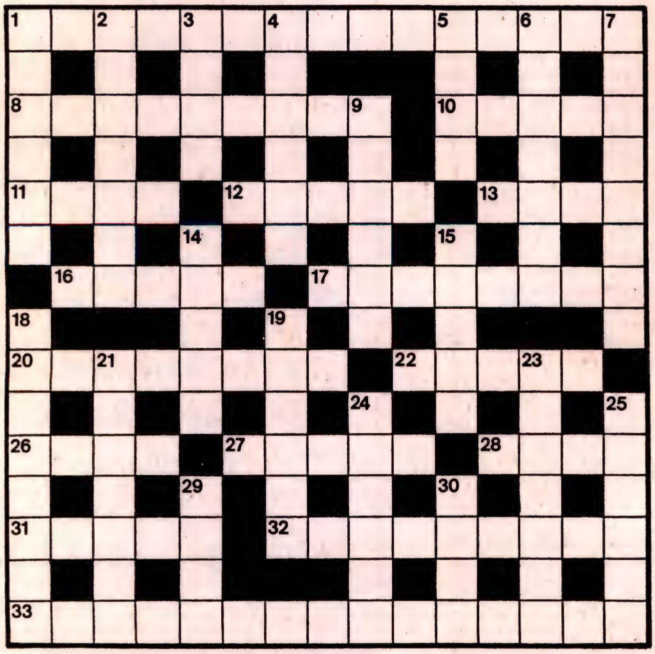
The centres covered by these new recommendations include Alice Springs, which is one of the larger of the centres at present not provided with television services.

The Postmaster-General has announced that the plan will be adopted as far as it affects Alice Springs and certain other areas. ◆

EA CROSSWORD

ACROSS

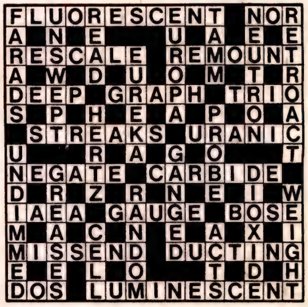
1. A regular EA feature. (7,8)
8. Part of the e/m spectrum. (9)
10. Prefix meaning over. (5)
11. TV picture fault. (4)
12. Base for circuitry. (5)
13. Operate a button switch. (4)
16. Plastic substance first made in 1935. (5)
17. Benjamin —— overthrew the caloric theory. (8)
20. Structured in a regular form. (8)
22. Interval between actions. (5)
26. Cross current carrier with control cables! (4)
27. Home of Sony. (5)
28. A key function on a cassette player. (4)
31. An electrode. (5)
32. Name of vehicle that won 1987 Solar Challenge. (9)
33. These follow 008. (4-4,7)



DOWN

1. Data storage. (6)
2. Branch within a learning centre. (7)
3. Particle. (4)
4. Part of an electric motor. (6)
5. Noise of tape. (4)
6. Disconnects from power source. (7)
7. Listening device. (8)
9. Grounds. (6)
14. Having properties of charged particles. (5)
15. Cause movement by force. (5)
18. Sir Mark ——, famous Australian physicist. (8)
19. Undergoes radioactive disintegration. (6)
21. Thin metal sheet. (7)
23. Teleprompter. (7)
24. Kind of connector (brand name). (6)
25. Colloquial name for an electrician. (6)
29. Very thin sheet of gold. (4)
30. Condition with zero anemometer readout. (4)

SOLUTION FOR MAY 1994


FLUORESCENT NOR
A N E U A E E
RESCALE REMOUNT
A W D U O M T R
DEEP GRAPH TRIO
S P H E A P O A
STREAKS URANIC
U R A G O T
NEGATE CARBIDE
D R Z R N E I W
IAEA GAUGE BOSE
M A C N E A X I
MISSEND DUCTING
E E L O T D H
DOS LUMINESCENT

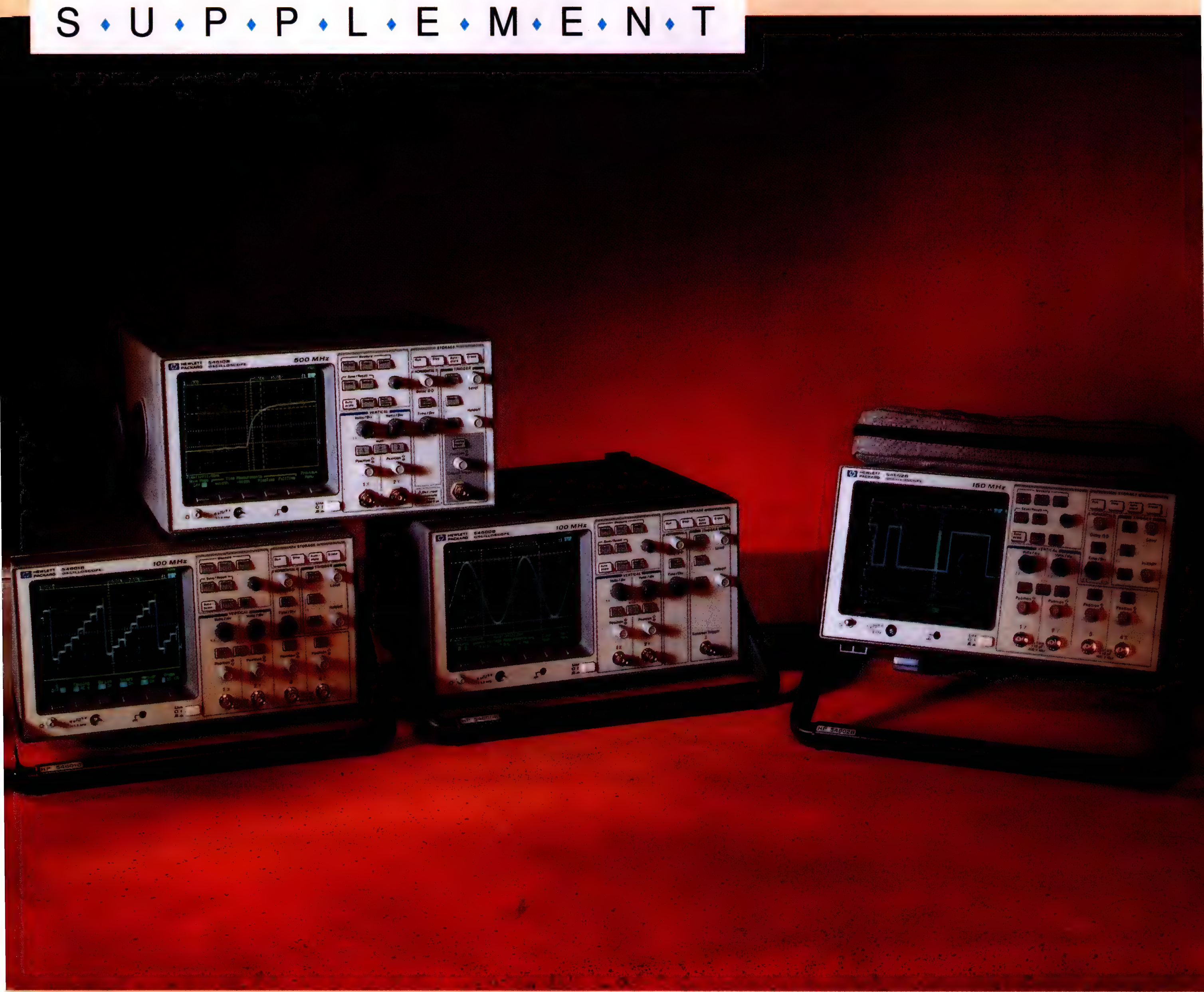
Electronics Australia's

Professional Electronics

SUPPLEMENT

NEW AUTOMATIC TRANSFORMER TESTERS FROM VOLTECH ARE FAST & EFFICIENT

SYDNEY GETS A NEW COMPONENTS SUPPLIER: PRIME (AKA ST LUCIA)



NEW VERSIONS OF HEWLETT-PACKARD'S 54600 FAMILY OF DSO'S OFFER VECTOR MODE DISPLAY, UPDATE AT 1.5 MILLION POINTS PER SECOND

NEWS HIGHLIGHTS

SYDNEY GETS NEW ELECTRONIC COMPONENTS OUTLET

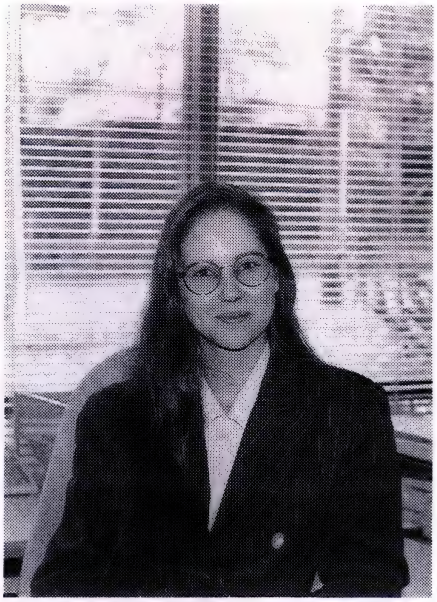
A new electronics component and equipment supplier has opened in Sydney: Prime Electronic Components, which is affiliated with long-established Brisbane firm St Lucia Electronics. Enthusiastic manager of the Sydney firm is Ms Jannifer Black, who was formerly spare parts supervisor at Akai Australia for some years, and also Queensland manager for Selectroparts.

Prime's current Sydney base and first wholesale/retail outlet is at 185 Parramatta Road, Flemington 2140; phone (02) 746 1211, or fax (02) 746 1197.

The showroom is unusually spacious, well laid out and designed to make it easy for customers to select from the large range of components, tools, test equipment, accessories and cables. Brands stocked include Arista, Fluke, Hakko, Cooper Tools, Scope, Electrolube, Nilsen Instruments, Emona Instruments, Warburton Franki, Lutron, Soanar/Arlec and Luxo.

A comprehensive range of spare parts is also stocked for the servicing industry, including parts for Panasonic, Sharp, Akai, Sanyo, Mitsubishi/AWA and Samsung.

Ms Black says that Prime's main goal is in fact to provide a premium source of spare parts and equipment for the service and manufacturing industry, with a superior stock range and a lot of emphasis on maintaining stock levels. In short, to be a 'one stop shop' for service technicians and small manufacturers.



Ms Jannifer Black, manager of Sydney's new components store at Flemington.

However she added that "We're happy to serve hobbyists and the public as well!" Ms Black also noted that Prime expects to release a catalog later in the year, to assist its customers in ordering.

1994 ATERB SCHOLARSHIPS

The Australian Telecommunications and Electronics Research Boar (ATERB) has this year awarded eigh one-year postgraduate scholarships, eac worth $11,000 tax free and with the possibility of extending to three years. The 1994 Scholarship recipients are:

- Lachlan Andrew, University of Melbourne (A Comparison of Neural Network and Classical Techniques fo Image Coding)
- Michael Cahill, University of Melbourne (Photonic Code Division Multiple Access (CDMA) Networks)
- Min Vui Chan, University of Melbourne (Wavelength Switching and Routing)
- Jason Choong, University of Melbourne (Traffic Modelling of Wireles Communications Networks)
- David Leask, University of Melbourne (Hardware Implementation of Adaption Layers in a Multimedia Terminal)
- Matthew Ma, Australian National University (Optical Fibre Non-Linearities)
- Ian Oppermann, University of Sydney (Code Division Multiple Acces Systems)
- David G. Salinas, University of Sydney (Grain Gratings in Optical Fibres)

The Australian Telecommunication and Electronics Research Board is jointly sponsored by Telecom Australia CSIRO and DSTO.

AF TRANSFORMER DESIGN SERVICE

Sydney-based toroidal transforme manufacturer Tortech has expanded it activities to include the design an manufacture of toroidal audio trans formers, and can now offer a computer based design and performanc simulation facility for customers wh need such transformers.

The facility has already been used t design audio output transformers fo both valve and solid state amplifiers, an also transformers for matching electros tatic loudspeakers.

Tortech's chief designer Mike Larki notes that the advantage of the new com puter simulation facility is that "We can design the correct transformer efficiently, and produce a prototype that is right first time".

Tortech can manufacture toroidal transformers with power ratings from 20VA to 7.5kVA. The company is approved to Australian Standards AS3108, and all transformers are made to QA guidelines to ensure guaranteed performance. Further information can be obtained from Mike Larkin on (02) 642 6003, or fax (02) 642 6127.

C-CUBE LICENCES GI'S DIGICIPHER II

General Instruments has licensed its DigiCypher II video compression technology to chip maker C-Cube Microsystems, for use in its Multimode Video Decoder and VideoRISC Video Encoder products (which also support the MPEG-2 standard).

The C-Cube video encoders and decoders using the new technology will be made available to GI and other equipment makers which have licensed the DigiCypher II system. The licensees include Hewlett-Packard, Scientific Atlanta and Zenith.

PANAMSAT DELAYED

According to *Coop's Technology Digest* (March 25, 1994), the Ariane rocket launch failure in late January is likely to produce a delay of at least three months to launches scheduled for the remainder of 1994 and early 1995. This means that the PanAmSat PAS-2 satellite, to be positioned at 169°E where it will be able to cover much of Australia (as well as other Pacific Rim countries), will possibly not be launched now until mid-August.

As a result, the satellite may not be operational until mid October. The USA's DirecTv service decided not to risk the scheduled July launch of its second DBS satellite, and has switched from Ariane to an Atlas launch vehicle.

OZ CELLULAR SYSTEMS TO CTI

Stanilite Electronics has announced a contract to supply a further 15 of its Cellswitch cellular telephone systems to CTI, the consortium operating Argentina's national cellular telephone network. The A$2.5 million contract is for the supply of the equipment, spare parts, installation and commissioning services. All 15 of the additional systems were to be shipped in the first three weeks of April

This contract follows on from Stanilite's A$16.5 million supply of 70 Cellswitch systems to the CTI consortium earlier this year. The entire order for the first 70 systems was shipped in under three months, meeting all schedules stipulated in the first contract.

Ericsson claims that its new GH337 is the world's smallest digital mobile telephone for the GSM system. It measures 130 x 49 x 24mm, and weighs only 200 grams — including a battery which powers it for up to 80 minutes of use.

GOVT SOURCING GPS FROM USA

NAVSTAR GLOBAL POSITIONING SYSTEM
IONOSPHERIC CALIBRATION SYSTEM
TurboRogue ICS-4000Z
ALLEN OSBORNE ASSOCIATES

The Australian Government has chosen US manufacturer Allen Osborne Associates Inc as its prime supplier of Key equipment for a new GPS (Global Positioning System) based national geodetic and mapping network.

This is the second Pacific Rim order in a short space of time for the company, which recently supplied GPS equipment to Taiwan.

The system will comprise 11 high performance ICS-4000Z TurboRogue GPS receivers, forming an integral part of a network of automated monitoring stations situated throughout the Australian mainland and at several offshore locations. Once operational, they will make use of US military GPS satellites now available for civilian applications.

Currently, there is a network of precise GPS receiver sites in international service, but few in the southern hemisphere. According to Dr Robert Snow, Allen Osborne Associates' Vice President of Business Development, the new network will contribute greatly towards creating a truly global system.

"The TurboRogue is capable of digitally tracking up to eight GPS satellites simultaneously and independently", he says. "It has a very accurate tracking performance and the ability to minimise loss of lock by the receiver on the GPS satellites".

As well as mapping and surveying, the Australian network will be used for navigation, ionospheric monitoring, GPS system integrity monitoring and determining the precise orbital characteristics of selected GPS satellites in order to verify their positioning accuracy. This information will then be supplied to the International GPS Service, a cooperative body comprising NASA, the European Space Agency and other scientific groups around the globe.

Since the first systems arrived in Argentina, Stanilite has had several teams of engineers concurrently commissioning them, and to date CTI have expressed great satisfaction with the network roll-out progress.

AUST GROUND STATION FOR GRO

NASA has opened a new, remote ground station in Tidbinbilla, Australia — the GRO Remote Terminal System — to receive scientific data from the Compton Gamma-Ray Observatory (GRO) via a Tracking and Data Relay Satellite (TDRS) which was moved into position over the Indian Ocean.

The decision to build the ground station and devote a TDRS to the Compton GRO came after the observatory's tape recorders failed, restricting transmission of scientific data to real time only. Since Compton was compatible with TDRS, this ground station option was feasible. An in-orbit repair of the Compton GRO was an alternative, but would have been much more costly.

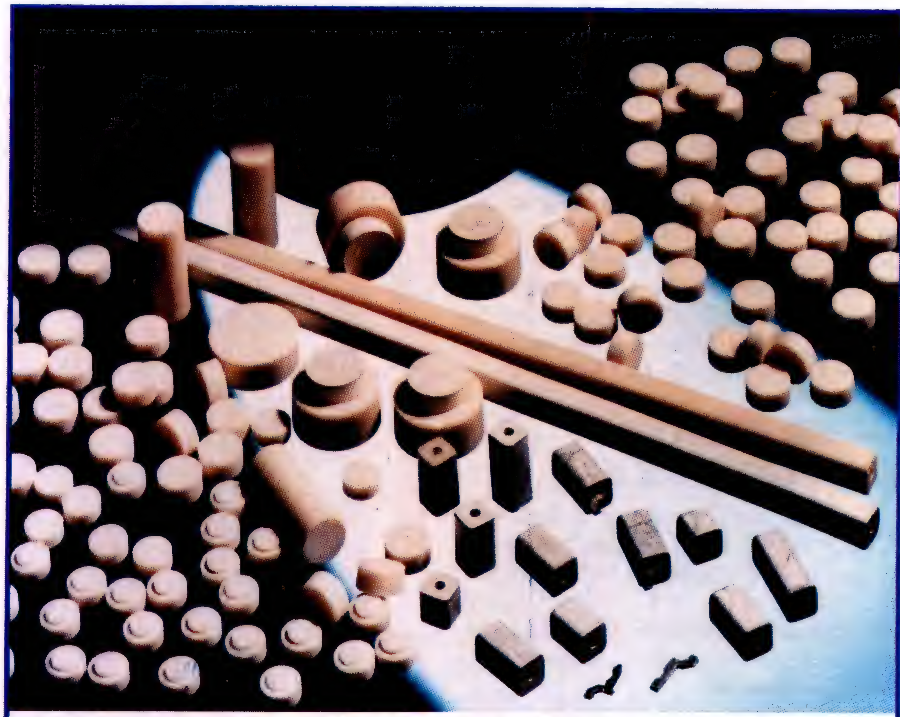
"While the new ground station is devoted to Compton at this time, it has the potential for use by other Earth-orbital spacecraft. The TDRS system was designed to operate with all the TDRS spacecraft in view of a single ground station. As a result, coverage could not be provided in a small region on Earth — the so-called Zone of Exclusion over the Indian Ocean. With activation of this ground facility, the TDRS system can, for the first time, provide global coverage," said Charles Force, Associate Administration in NASA's Office of Space Communications, Washington, DC.

Work on the station was completed in a relatively short time and within its US$12 million budget. Work began in September 1992 to implement a remotely controlled terminal at an existing NASA site and was a cooperative effort between the Australian Space Office and NASA.

PNG SATELLITE CONTRACT TO S-A

Scientific Atlanta has signed a US$3.3 million contract with Papua New Guinea's Post and Telecommunications Corporation to upgrade the country's domestic satellite system.

Scientific Atlanta will provide PTC with equipment and services to transfer the operation of PNG's domestic satellite system from PALAPA to INTELSAT. Scientific-Atlanta will also upgrade the system from a microwave restoration network to one that provides permanent distribution of voice, data and fascimile services to PNG's major urban areas.



British company Morgan Matroc has released a new range of low cost microwave resonators made from three new electro-ceramic materials, claimed to 'sound the death knell' for traditional metallic cavities in the next generation of RF systems. The resonators use barium-zinc-tantalate, barium-neodymiam-titanate and magnesium-calcium-titanate, which allow optimisation of performance as high as 26GHz.

AT&T PLANT FOR AUSTRALIA

AT&T has announced plans to develop an advanced cable manufacturing facility in Australia to produce cabling products in support of its Structured Cabling System, SYSTIMAX.

The new manufacturing facility will be the sole source of supply for this high demand cabling product within the Asia Pacific region. The total direct investment will be in excess of $20 million. Although a highly automated production, AT&T initially plans to employ more than 40 people, and plans to grow significantly over the years, in response to increasing market demand within the region. The exact location for the factory has not yet been finalised.

"We are pleased to have chosen Australia for the location of our SYSTIMAX cable manufacturing factory in the region," said Mr Chip Barton, Managing Director, AT&T Australia. "Australia's large use of high speed data networks, its sophisticated business infrastructures, the availability of good raw materials, coupled with its strong base of technology makes it a perfect match to our mission to deliver quality products."

In addition to supplying the Australian

NEWS BRIEFS

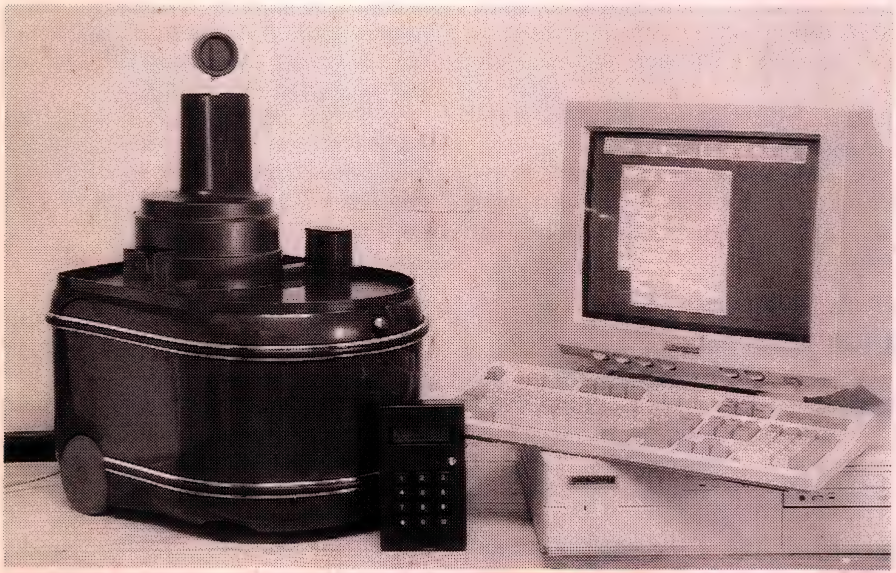
- Mr Artur Schechtman of Brazil has been elected Chairman of the Inmarsat Council for the coming year. He succeeds Mr Jean Paul Brillaud of France, whose term ended with the conclusion of the Council's 48th meeting in London on 2 March 1994.
- ***IIR Conferences*** has announced a seminar on broadcasting, called **Future Directions In Broadcast Programming** to be held at the Hyatt Kingsgate, Sydney, on June 20-21, 1994. Guest speakers will include Communications Minister Michael Lee. For more information phone (02) 954 5844.
- ***Philips Industries Holdings Limited*** has announced its activities in Australia are to come under the name of **Philips Electronics Australia Limited** from 21 March 1994.
- ***TDK*** has appointed Brett Campbell as its NSW Sales Representative to handle sales of its audio/video tapes and accessories.
- ***ELENEX Australia 94*** the 6th Australian International Electrical and Electronic Industries Exhibition will be staged at the Royal Exhibition Building, Melbourne 18-21 October 1994. For further information contact Noel Gray (03) 867 4500. ◆

market, AT&T expects to export more than half of the cabling products manufactured at this new facility. Scheduled to begin operations during the first quarter of 1995, the new factory will rely primarily on locally available raw materials for its production of Category 5 UTP cabling products.

NEW ROBOT FOR TEACHING

Branch and Associates, the Tasmanian robotics company, have released a new educational and research robot called 'Fander'. The robot can serve as a teaching tool in engineering and information science departments in universities and colleges. It is also a mobile research platform and is proving useful to companies and executives involved in robotic research.

Fander is battery powered and contains its own 386 computer. Peripheral control is via a custom expansion card designed and made in Australia. Fander is essentially a stand alone device and all programs and algorithm modifications can be made via the integral keypad and LCD screen, at any time.



However, an RS232 link can be used to interface the robot to another computer and monitor, thus enabling the user to get full graphical representation of the available demonstrations.

Claimed to be in a class of its own, Fander gives the user demonstration programs in mapping, line following, wall following, random walks and reaction to external stimuli (tropism).

Branch and Associates have recently acquired a controlling interest in the Denning Mobile Robotics Company in the USA. Mr Allan Branch has been appointed President and CEO. The Fander robot will be marketed in the USA under the Denning name, and agents have also been appointed in Europe.

US COMPUTER EXPERT AT SYDNEY SEMINAR

Professor Greg McRae, recognised international authority and adviser to the US Administration on high performance computing and communications (HPC&C), addressed a recent seminar at The Earth Exchange Museum in Sydney.

Organised by The Warren Centre for Advanced Engineering within the University of Sydney, the seminar followed the success of the 1992 study, 'Engineering the Future with High Performance Computing'. Led by Greg McRae, this project brought together more than 60 participants from Australian industry, government and universities to demonstrate the value of HPC&C technology to solve a wide range of practical applications.

Professor McRae is Professor of Chemical Engineering at the Massachusetts Institute of Technology and fills senior advisory roles for the US National Science Foundation and the White House.

Born and educated in Australia, Professor McRae has had a long and distinguished career in research and teaching in the US as well as international consulting on Air Quality Modelling and High Performance Computing.

A number of speakers from business, HPC&C centres, State governments and research institutions also addressed the seminar which was opened by Dr John Bell, Chief Science Adviser of the Commonwealth Department of Industry, Science and Technology who said, "Unless we improve industry access to supercomputing facilities, we will fall behind our international competitors."

TELECOM PAY-TV CONTRACT TO PHILIPS

Telecom Australia has awarded a $160 million-plus contract to Philips to provide the technical equipment and know-how to deliver full interactive television to Australian audiences by mid to late 1994. Philips won a protracted tender procedure against the US company AT&T and the Australian manufacturing group Pacific Dunlop, from an original shortlist of seven.

The Chairman of Philips Electronics in Australia, Mr Justus Veeneklaas, said Telecom Australia's decision to choose Philips as its systems integrator and core network supplier in establishing its national Broadband Services meant Australia is well placed to lead the world in providing planned digital information super highway capabilities.

Mr Veeneklaas added that the strong combination of Telecom's outstanding performance as a carrier, and Philips' technology development leadership and service experience, would ensure rapid and successful implementation of customer Broadband Services.

This is the largest contract ever awarded to Philips Australia, which was established in 1926. The contract will be managed by Philips Public Telecommunications Systems, headed by Mr Brian Adams and headquartered in Melbourne.

Under the contract announced by Telecom, Philips deliveries will include cable and cable transmission equipment. As the systems integrator for the Broadband Services network, Philips will design, optimise and build into the network upgrade capacity.

Philips is working with Telecom to decide upon the set-top units and associated facilities which will add a further $90m to the project. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

Easy to use programmable amp

The PGA103 from Burr-Brown is a monolithic digitally programmable amplifier available in eight-pin DIP and SO-8 surface mount packages. Gains of 1, 10 and 100 are digitally selected by two TTL or CMOS-compatible control lines, giving an easy to use solution for systems that must handle wide dynamic range signals. The device suits a wide range of applications, including process control, medical instrumentation, test/measurement equipment and general-purpose analog boards.

The settling time of the PGA103 is around 2.5us for gains of 1 or 10, and 8us for a gain of 100; fast enough to use in multiplexed data acquisition systems. Bandwidth is 250kHz at a gain of 100 and the quiescent current is 2.6mA. Depending on the gain, the gain steps have an accuracy of better than +/-0.2%.

The amplifier operates on voltages from +/-4.5V to +/-18V and is specified over the extended industrial range of -40°C to +85°C.

For further information circle 276 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 2700.

3V uP supervisor

Maxim has announced its microprocessor supervisory circuits designed specifically for 3V and 3.3V systems. These devices offer true battery-backup switchover, which is difficult to achieve at 3V. Choosing the higher of the backup battery or mains supply, as done by 5V uP supervisors, would lead to erroneous backup switchovers, since the backup battery is typically greater (3V to 3.6V) than the main power supply (2.7 to 3.6V), during normal operation. The new devices avoid this problem by switching over to the backup battery only when the main supply has fallen below 2.4V.

The supervisors provide four functions.

1. A reset during power-up, power-down and brownout conditions.
2. Battery backup switching for CMOS RAM, CMOS uP or other low-power logic.
3. A reset pulse if the watchdog timer has not been toggled within 1.6 seconds.
4. A 1.25V threshold detector for power-fail warning or low-battery detection, or to monitor a power supply other than +5V.

The devices feature a precision supply voltage monitor, a 200ms reset time delay, a 1.6 second watchdog timer and a 50nA battery supply current in battery-backup mode. The part numbers are MAX690RST/MAX802RST (200uA quiescent current) and MAX804RST/MAX805RST (50uA).

For further information circle 275 on the reader service coupon, or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

400V/250V form C solid state relay

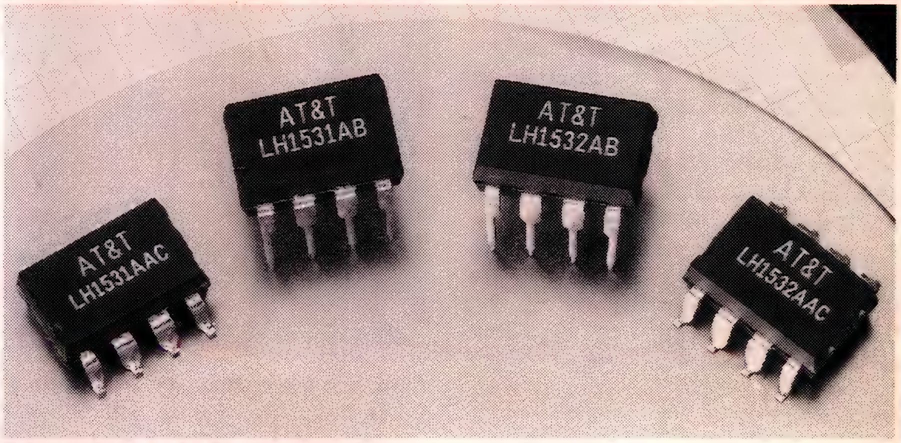
Claimed as an industry first, AT&T has announced a single chip solid state form C relay with guaranteed break-before-make operation. This ensures that the two outputs are never on at the same time.

The LH1527 (the 400V version) and the LH1537 (the 250V version) are the first optically coupled form C solid state relays available in a six pin package. The devices are true form C solid state relays, with a normally-closed, normally-open and a common output. Advantages over other solid state relays include smaller size, faster actuation times, and higher breakdown voltage. An eight pin version is also available which allows independent form A and form B operation. The devices are available in DIP and surface mount gull wing packages.

For further information circle 274 on the reader service coupon or contact Zatek Components, 1059 - 1063 Victoria Road, West Ryde 2114; phone (02) 874 0122.

5V precision voltage reference

Burr-Brown's new REF05 is a high performance, precision +5V voltage reference which is a pin for pin replacement for the industry standard REF-05. It has a guaranteed long term output voltage drift of 25ppm/1000 hours (max). Applications include precision regulators, test equipment, constant current sources, digital voltmeters, A/D and D/A converters, and portable instrumentation.



Dual solid state relays

Zatek has announced AT&T's new dual form A (normally-open) solid state relays, the LH1531 and LH1532. The devices are for low current applications and will switch up to 350V (AC or DC) at up to 110mA while providing extremely high off-resistance and very low switch offset. This makes them ideal for instrumentation, test equipment and telephone switching applications. The two devices differ in that the LH1531 has an integrated Vbe multiplier that allows very fast turn-on, while the LH1532 has on-chip current-limiting circuitry to provide protection from voltage surges. The ICs feature 3.75kV AC input-to-output isolation in a double-moulded package.

For further information, circle 277 on the reader services coupon, or contact Zatek Components, 1059 - 1063 Victoria Road, West Ryde 2114; phone 874 0122.

Compact CQFP 128K x 32 SRAM

White Technology has introduced the WS-128K x 32 CMOS family of compact SRAM 32-bit configured memory modules. Designed for surface mounting, these compact 68-pin ceramic quad flat pack (CQFP) devices are housed in a hermetic ceramic package. They are offered in a 35mm (1.38") square dimension and stand 5.5mm (0.215") high. A 3.55mm (0.140") package for low profile applications is under development, as is a 512K x 32, 16-megabit SRAM. The new devices are an alternative to the industry standard 32-pin x 8 DIP configuration, and provide denser packaging than equivalent organisations in DIPs.

The modules are constructed on a multilayer ceramic substrate and hermetically sealed with a welded metal cover. Because of their rugged construction and small size, they have better mechanical stability in applications where acceleration, shock, vibration and space are major considerations.

These SRAM devices have access times from 20ns to 120ns and feature low power CMOS design, TTL compatible inputs and outputs and five volt operation. RAD tolerant devices are available in some speeds.

All devices are also available in a compact PGA type 66-pin hex-in-line hermetic ceramic package that measures only 30.1mm (1.18") square and standards 5.7mm (0.225") high.

For further information contact White Technology, 4246 E.Wood Street, Phoenix, Az 85040; phone (602) 437 1520, fax (602) 437 9120.

The REF05 provides a stable +5V output which can be adjusted over a +/-6% minimum range with minimal effect on temperature stability. It operates from a single supply input range from 8V DC to 40V DC with a current drain of 1mA. It uses a buried zener technology, which has a temperature stability of 8.5ppm/°C (max) in the -55°C to +125°C temperature range.

Key specifications for the device include +5V +/-0.1% (max) output voltage, 10uVp-p (0.1Hz to 10Hz) noise, 0.008% (max) line regulation, 0.005%/mA (max) load regulation and 1.4mA (max) quiescent current. Operating over the extended temperature range of -40°C to +85°C, the REF05 is available in an eight lead hermetic TO-99 metal package.

For further information circle 271 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 2700, fax (03) 878 0824.

High frequency solid state relay

Zatek has available AT&T's LH1514, the first solid state relay to perform in high frequency, low on-resistance applications such as protection switching in a telephone network. It provides a compact solid state solution that consumes less power than electromechanical relays, and is available in a surface mount package.

The LH1514 provides fast actuation and a highly reliable connection for critical T1 protection switching. It is capable of switching DI1, DS1A (CEPT), DS1C and DS2 rates from T1 carriers, and is also ideal for multiplexing in digital access cross connects (DACs) and channel banks, and for intra-office data routing.

The LH1514 is a low on-resistance solid state relay on a monolithic receptor die. It is optically coupled and does not require a power supply to operate. High frequency operation is achieved by integrating 'T' termination into the die. It features an isolation voltage of 3.75kV RMS.

For further information circle 273 on the reader service coupon or contac Zatek Components, 1059 - 1063 Victoria Road, West Ryde 2114; phone (02) 874 0122.

High sensitivity 0.25" CCDs

Toshiba has developed two 0.25" charged coupled devices (CCD) area image sensors with a photosensitivity of 590mV, a new high for the industry. Cameras incorporating the sensors will be able to operate in very low ambient light. The new devices are the TCD5391P for NTSC and the TCD5381P for PAL, incorporating 270,000 pixels and 320,000 pixels respectively. CCD image sensors are widely used in home use camcorders, broadcasting cameras and medical cameras.

CCDs are made of multiple image sensor cells, each consisting of a photodiode and a vertical resistor. The individual cells are covered by a single beam condensing on chip microlens that focuses light onto the photodiode, increasing sensitivity to the light beam.

The energy of the beam is converted to an electric charge, read out through the resistor to the output section. At this point, the charge is converted into a voltage signal.

The new device optimises the relative sizes of the photodiode and vertical resistor in each cell, so as to maximise efficiency and increase the sensitivity of the CCD.

If the photodiode is too big, the vertical resistor will be too small to read out the entire charge it generates. If the vertical resistor is too big, the electric charge from the photodiode is insufficient and sensitivity is reduced.

For further information, contact Toshiba Australia, PO Box 350, North Ryde 2113; phone (02) 887 3322. ❖

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Test & Measuring Feature:

MICRO-CONTROLLED TRANSFORMER TESTERS

British firm Voltech, well known for its power analysers, has expanded into a new area with the release of its compact AT3500 and AT1000 automatic transformer testers. These can be easily programmed to perform a sequence of standard tests on transformers and inductors, at frequencies up to 300kHz. They also have provision to either print out the results or send them back to a PC server for data logging, etc.

by JIM ROWE

Traditionally, effective testing of transformers and inductors has involved a fair amount of expensive equipment and some skilled people to drive it. Even then, it can be quite time consuming — so overall, it's a costly business. Yet at the same time, it's also a crucial one, for both transformer makers themselves and for many of the firms which use them in their own products.

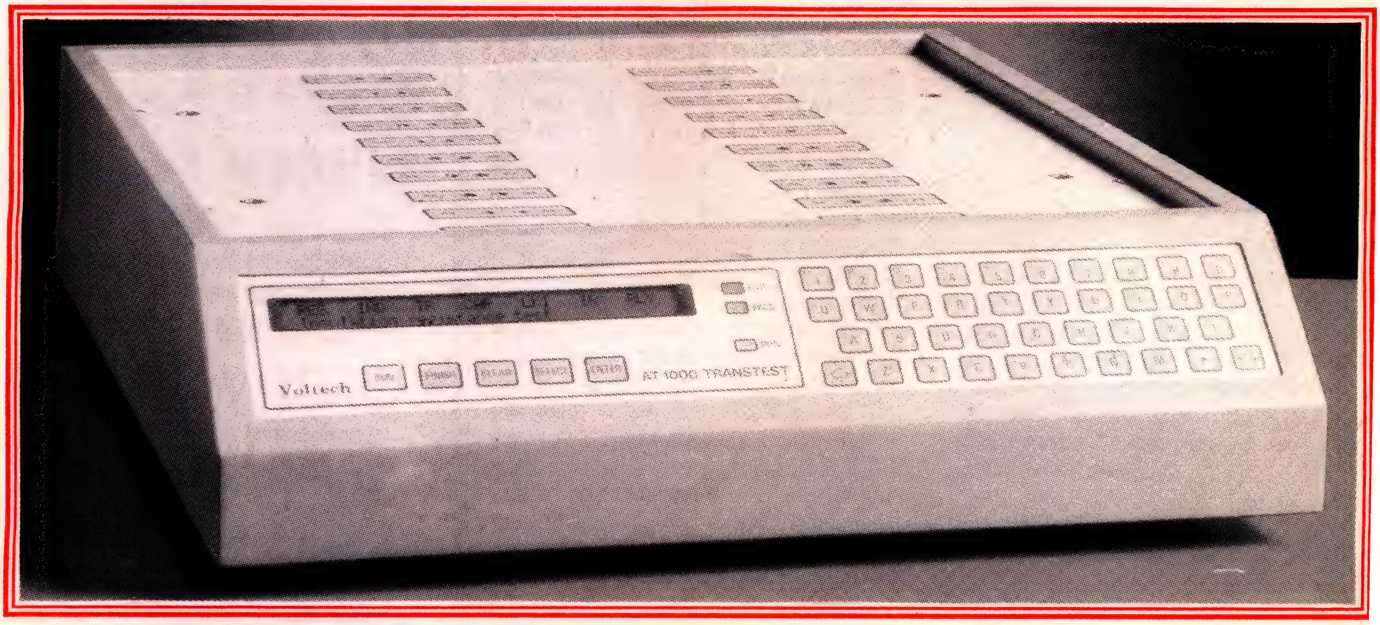
Nowadays, there's increasing pressure on transformer makers to be able to guarantee that their products meet specifications, and international standards. This can generally only be done by 100% testing before despatch. Meanwhile, equipment makers often need to protect themselves by performing 100% QA testing on all components on arrival, before they're built into expensive or critical systems.

While many electronic components, both passive and active, can now be tested automatically and efficiently, until very recently this has not be easy with wound components like transformers and inductors. Only the largest manufacturers have been able to justify the kind of specialised testing facilities, often with robotic handling equipment, that has been required.

Happily British firm Voltech has now changed all this, with its development of two new automatic testers which are compact enough to sit on a standard bench top. About the size of a flat-bed A3 image scanner, the AT1000 and AT3500 can carry out a wide range of standard transformer/inductor tests, under the control of an inbuilt microcomputer. And they can be easily programmed, either directly from the front panel or by downloading from a PC, to conduct a complete sequence of tests rapidly, in response to a single press of a button.

This means that once set up, the testers can be operated rapidly and efficiently in a production or QA environment by unskilled labour — allowing a big saving in costs compared with the traditional approach.

To make setup more efficient as well, the testers are designed to take interchangeable test fixture plates, which plug into an array of sockets in the top of the tester and are attached by means of quick-release screws. By having a set of these plates, each set up with test fixtures to suit different transformer/inductor sizes and models, the testers can be set up to test different components in short order. The socket array on the top of the testers has 20 pairs of sockets, for driving and Kelvin sensing of up to 20 measurement nodes.



In addition, the testers include program memory based on EEPROMs, which can store the testing programs for many different models for virtually 'instant' recall. Hence once the testing programs have been created, finalised and stored in memory, the involvement of skilled staff is minimal.

The AT1000 tester

The AT1000 is functionally the simpler of the two testers, and is designed for users who only need to perform the six most common tests:
Winding resistance; Turns ratio and phasing; Inductance; Leakage inductance; Inter-winding capacitance; and Insulation resistance.

Winding resistance can be measured over a wide range, from 500uΩ to 100k, with an accuracy of +/-1% of reading +/-1mΩ and a measurement time of around 0.5s. The range for turns ratio is also very wide — from 0.0003 to 3000, with a test frequency adjustable between 20Hz and 100kHz and in amplitude between 10mV and 5V RMS. Accuracy is again +/-1% of reading (+/-0.05% per kHz), with a testing time of around 0.8s for the first ratio, and 0.4s for later ratios.

Inductance can be measured in the range 500nH - 10kH, over the frequency range from 20Hz to 300kHz and with a test signal amplitude of again 10mV - 5V RMS. The DC bias current can also be set in the range 0 - 500mA. Quoted accuracy is +/-1% of reading +/-100nH +/-0.1% per kHz, or typically +/-10% for a Q measurement of 30 at 1kHz. Measurement time is around 1s.

Leakage inductance can be measured in the range 500nH - 10H, over the same frequency range as for inductance and with a test signal amplitude range of 10mV - 1V RMS. Quoted accuracy here is +/-3% of reading +/-100nH +/-0.1% per kHz, and the measurement time is around 2.1s.

The inter-winding capacitance test has a measurement range of 5pF - 1uF, with a frequency range of again 20Hz - 300kHz and a test voltage range of 10mV - 5V RMS. The quoted accuracy is +/-1% of reading +/-3pF +/-0.1% per kHz, and the measurement time is around 1.1s.

Finally the insulation resistance test measures from 1M to 10GΩ, with a test voltage adjustable from 50V - 500V DC and a dwell time adjustable from 100ms to 60s. Quoted accuracy is +/-5M at 100M. The AT1000 has a sealed membrane type QWERTY keyboard built into the front panel for programming and setup, with a two-line LCD panel for menu display and parameter value readout. A set of five separate keys is used for testing control, etc, with a pair of LEDs for PASS/FAIL test indication and a beeper for optional audio indication of failures.

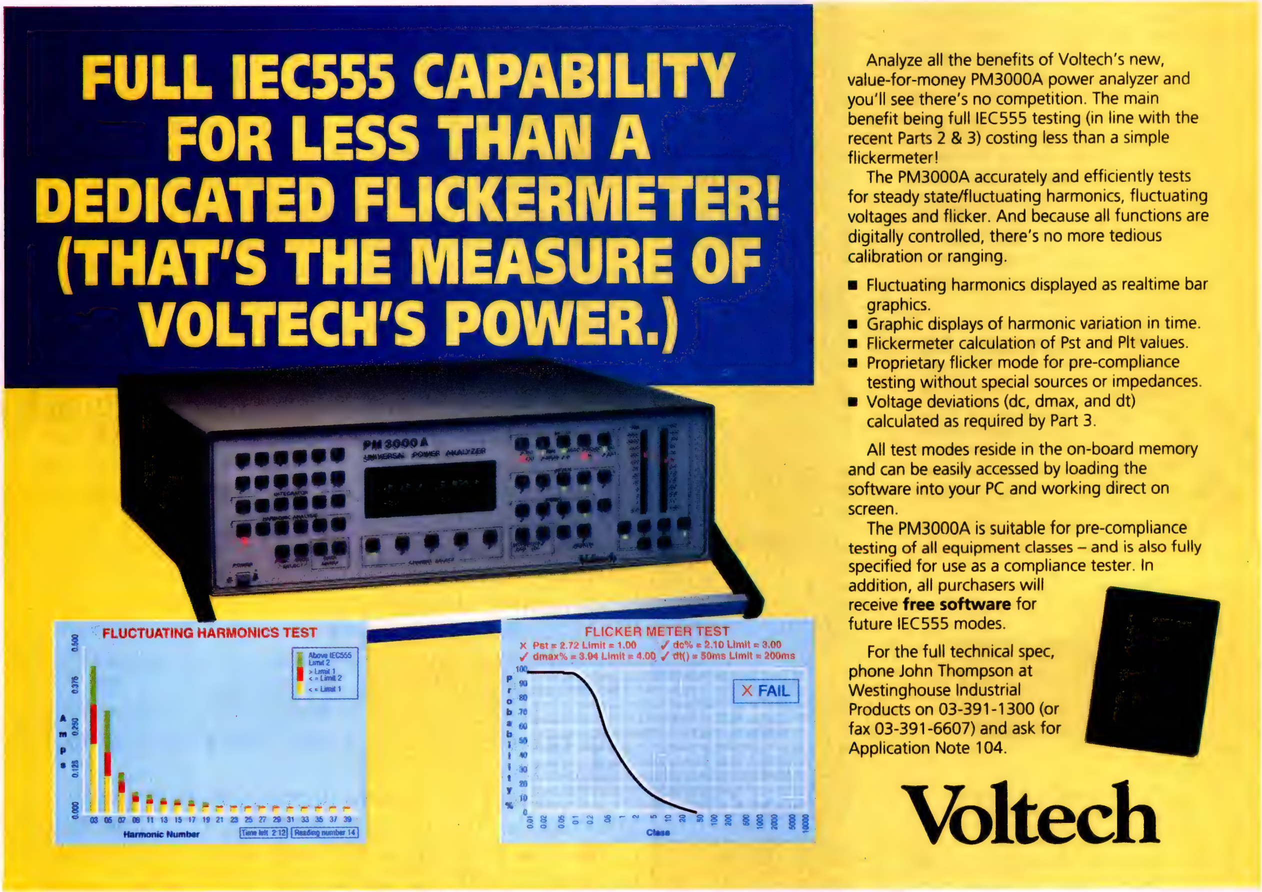
At the rear of the unit are both parallel and RS-232C printer ports (for driving a printer directly, to print out batch test results), an RS-232C serial communications port for interfacing the AT1000 to a PC server, and sockets for interfacing to a foot switch and for control of a text fixture.

Physically the AT1000 tester measures only 427 x 105 x 500mm, and weighs 10kg. It has a power consumption of only 15W, and can operate on supplies of 90 - 260V AC, 47 - 63Hz.

The AT1000 comes complete with manual, cables, a 3.5" floppy disk with PC server software, and one 20-node test fixture plate. Additional plates are available as options, as are calibration fixtures, printer cables and a maintenance manual.

The AT3500

The AT3500 tester is the larger of the two, and provides facilities for additional tests as well as a wider measurement range for some of the same tests as performed on the AT1000. It's designed to



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All test modes reside in the on-board memory and can be easily accessed by loading the software into your PC and working direct on screen.

The PM3000A is suitable for pre-compliance testing of all equipment classes – and is also fully specified for use as a compliance tester. In addition, all purchasers will receive **free software** for future IEC555 modes.

For the full technical spec, phone John Thompson at Westinghouse Industrial Products on 03-391-1300 (or fax 03-391-6607) and ask for Application Note 104.

Voltech

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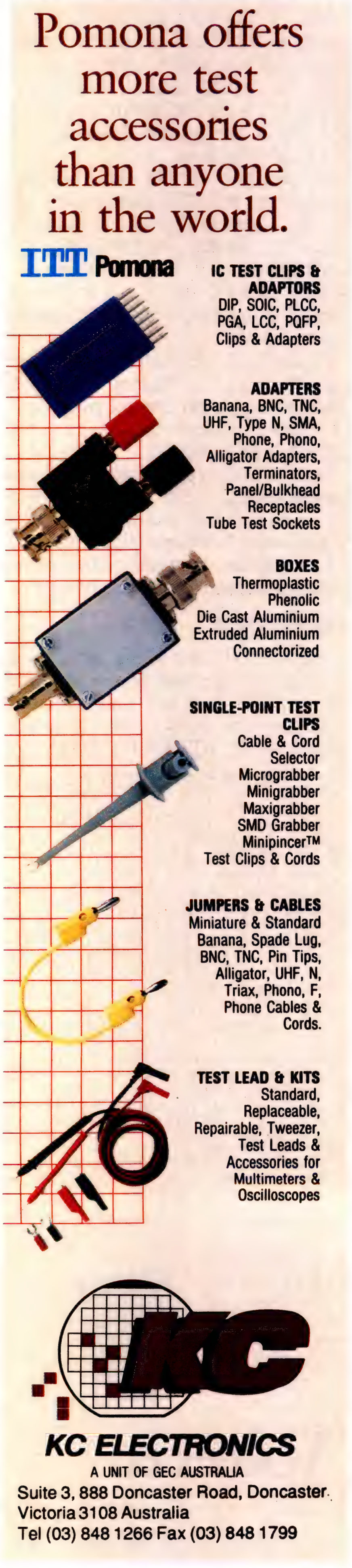

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READER INFO NO. 26

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Transformer Testers

perform virtually *all* of the tests required for a complete evaluation of transformers and inductors, and also includes additional facilities such as a built-in printer and an automatic safety-interlocked lid.

In addition to the tests performed by the AT1000, the AT3500 checks magnetising current, open-circuit voltage, inter-turn stress/watts loss, inter-winding leakage current, and 'Hi-Pot' tests — the application of AC voltages of up to 5kV between windings and/or the core, to check for insulation breakdown.

The AT3500 specs for the six basic tests are very similar to those for the AT1000, except that in a couple of places it's better. The turns ratio range covered is from 0.0001 to 10,000, for example, while the maximum test voltage for many of the tests is 10V RMS instead of 5V, and 850V DC for the insulation resistance test rather than 500V.

The additional test for magnetising current has a range of 100uA - 2A RMS (4A peak), with source voltage adjustable from 10V to 500V RMS and from 20Hz to 2.5kHz. The quoted accuracy is +/-1.5% of reading +/-5uA below 10mA, and +/-0.5mA above 10mA. Testing time is around 1s, but depends upon the current settling time.

The open-circuit voltage test has a range of 0 - 500V RMS AC (or 0 - 800V DC), and has an accuracy of +/-1% of reading +/-10mV. Testing time per measurement is approximately 450ms. The inter-turn stress/core loss test has a range of 0 - 50W, and the testing voltage can be either a sinewave (10V - 500V RMS) or a squarewave (+/-10V to +/-800V peak), variable from 20Hz to 2.5kHz for the sinewave or 500kHz for the square wave. Quoted accuracy is +/-2% of reading +/-(500uA x Test Voltage) +/-0.1% per kHz, and the dwell time is adjustable from 100ms to 60s.

The leakage current test has a range of 1uA - 1mA, with a test voltage adjustable from 10 - 500V RMS and a frequency range of 20Hz - 2.5kHz. Accuracy is quoted as +/-2% of reading +/-5uA, with a testing time of 1.2s.

Finally, the 'Hi-Pot' test has a voltage range of 500V - 5kV AC, at a frequency of either 50 or 60Hz and a trip level of 1 - 15mA peak. The ramp-up, dwell and ramp-down times are each independently programmable from 100ms to 60s. Accuracy of test voltage setting is +/-3%, and for trip current level +/-0.5mA.

The AT3500 has a control panel similar to that of the AT1000, with a fluorescent display panel and the inbuilt printer at the lower left. The instrument is also somewhat larger (484 x 310 x 545mm, 27kg), due to the additional EHT circuitry and the automatic safety lid and actuator.

The bottom line

Although superficially the AT1000 and AT3500 may seem expensive at the quoted prices of around $20,000 and $40,000 respectively, they actually compare very well with the alternative equipment required for transformer and inductor testing.

In any case, their ability to perform fast and highly efficient testing automatically, with a very low level of operator skill or training, means that in a production environment they typically pay for themselves in a surprisingly short time.

Additional benefits are of course the ability to perform tests at frequencies of up to 300kHz, and the facilities to provide automatic logging of test data for auditing, etc.

Companies involved in 100% testing of wound components for guaranteed quality levels should therefore find them of great interest.

For further information, circle 201 on the reader service card or contact the Australian representatives for Voltech, Westinghouse Industrial Products, of 59 Stephenson Street, Spotswood 3015; phone (03) 391 1222, or fax (03) 391 6607. ❖

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READER INFO NO. 27

Special feature:

The latest in Test and Measurement Instruments

Compact digital storage 'scope

Amalgen Control Systems have announced their model 3850DML, a compact instrument that can be used as a digital storage oscilloscope, a logic analyser and a digital multimeter. Other features include battery and external DC or AC power. A printer output and RS 232C interface are available as options.

As a digital storage oscilloscope, the instrument has 50MS/sec sampling, two channels, eight-bit resolution and a cursor to indicate time interval, voltage difference and frequency.

The multimeter features a 4000 count bar graph, six measuring functions, including capacitance and frequency. The logic analyser has 16 channels, 2K word per channel and 50MS/sec sampling.

For further information, circle 208 on the reader service coupon or contact Amalgen Control Systems, 43 Anderson Road, Mortdale 2223; phone (02) 570 2855.

HP 54600 DSO's get vector displays

Hewlett-Packard Australia has introduced new versions of its HP 54600 series benchtop digital oscilloscope family, with enhanced real-time vector displays. Like analog scope displays, the enhanced displays give test and measurement engineers waveform slew-rate information at a glance, which allows them to troubleshoot circuits faster and more effectively.

Most DSO's show waveforms mapped as discrete dots or discrete dots connected with lines.

These display modes give users a good indication of waveform shape, but do not show differences in signal intensity or waveform slew rate. HP's new vector-enhanced displays on its 54600B series oscilloscope indicate waveform slew rates as analog oscilloscopes do — with brighter traces representing more slowly changing waveforms, and dimmer traces representing more rapidly changing waveforms.

A new custom display processor, one of three processors used in the digital architecture of HP 54600B series oscilloscopes, provides additional benefits including:

- A display update rate of 1.5 million points per second — a 50% increase in the amount of information displayed — so screen reflects changes in the waveform instantaneously;
- A fast screen-refresh rate of 60 times/s in vector mode, regardless of the number of waveforms displayed;
- Minimal display blind time, even in vector mode, for capture and display

Arbitrary waveform generators

Tektronix Australia has announced the latest additions to its 2000 series of portable, programmable arbitrary waveform generators. Claimed as the world's fastest and deepest arbitrary generator, the single-channel AWG 2040 features 1GS/s sampling and up to 4MB of memory.

The AWG 2005 can be configured up to four channels and has 20MS/s sampling and 64K of memory per channel. These generators can create, edit and output real world signal waveforms using a consistent, built-in graphical user interface.

Similar to PC-based drawing programs, the inbuilt graphical editor features functions like copy, paste, invert, clip and scale. Waveforms can be viewed in either the frequency or time domain and created directly from standard polynominal equations. The generator has a standard waveform library, including sin, triangle, square, ramp and noise waveforms.

For further information circle 201 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde; phone (02) 888 7066.

of infrequent events that other oscilloscopes miss.

The new HP 54600B series replaces the HP 54600A series. The B series oscilloscopes' easy-to-use analog-like controls and instant control panel response are ideal for troubleshooting applications. Additionally, the new oscilloscopes are fully compatible with existing interface and enhancement modules and with existing versions of HP 34810A BenchLink/scope software for moving oscilloscope data into Windows applications, and HP 54653A ScopeLink software moving oscilloscope data into DOS applications.

Each oscilloscope comes with two probes, operating and service manuals and a power cord.

For further information call Hewlett-Packard's Customer Information Centre on 131 347, extension 2902.

Digital pressure gauge

Intended as a replacement for dial gauges, the model DG digital pressure gauge is a microprocessor based product able to measure absolute and vacuum pressure. The DG family uses a solid-state sensor that is claimed to eliminate the inaccuracies inherent in dial gauges, while providing the durability found only in an industrial pressure transducer. The instrument has 200% over-pressure protection and includes buttons to control zero, the digital peak and valley feature and to turn the gauge on and off. The control buttons can be disabled if needed. Power options include self-contained battery power, loop power and external power and a variety of pressure port adapters allow the gauge to be incorporated into existing systems.

For further information circle on the reader service coupon or contact MTL Instruments, Unit 6, 13-17 Sorbonne Crescent, Canning Vale 6155; phone (09) 455 2994.

Benchtop DC power supplies

Protek have released four regulated DC power supplies, available through Amalgen Control Systems. The supplies cove an output range from 5V and 0-60V DC. Separate digital panel meters are provided for monitoring the output voltage and current simultaneously.

All models can be operated in either constant voltage or constant current mode. Each power supply comes with a 1.5m flexible input lead. For further information circle 204 on the reader service coupon, or contact Amalgen Control Systems, 43 Anderson Road, Mortdale 2223; phone (02) 570 2855.

LAN cable test set

International Data Sciences has introduced its Model 86 Tone'n Test LAN cable test set.

The test set comprises two small hand-held units: a model 86T transmitter, and a model 86R receiver and inductive tracer tone detector. Both units combine to perform an end-to-end test on each wire of each pair of a LAN cable. End-to-end tests ensure that all common cable faults are detected and identified.

The tester incorporates five of the most commonly used LAN tests into two small pocket-sized units. The five LAN test functions are: end-to-end LAN cable continuity and wiring tester; pair sequence tester for Ethernet, Token Ring and Category 5; tracer tone generator; inductive tracer tone detector that locates the far end of a cable; general purpose continuity tester. Both units contain three RJ45 modular jacks to interface with Ethernet, Token Ring and Category 5 types of cable. These jacks eliminate the need for sequence and wiring adapters.

For further information circle 206 on the reader service coupon, or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 73 4455.

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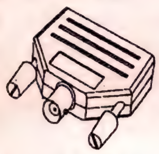

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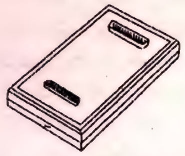

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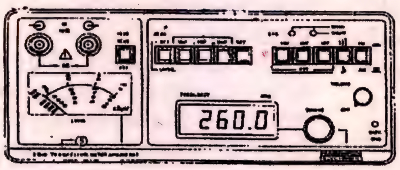

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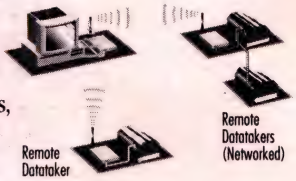

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READER INFO NO. 30

Test and Measurement Instruments

Digital test set

A new digital test set for troubleshooting and performance monitoring on digital transmission equipment in the range of 1200bP/s - 2Mbps is now available from Siemens. The test set model K 4315 is fully portable and comprises the K4305 digital analyser and a comprehensive interface panel, all housed in a robust aluminium attache case. Provision is made within the case for an optional battery powered printer.

The interface panel provides 1.6/5.6, V35 and 120 ohm — three contact connector access to all inputs and outputs of the analyser, hence there is no need for additional patch cords.

The K4305 can operate in the following modes: as an in-service monitor; drop/insertion of selected time slots; drop/repeat; unframed transmitter/receiver for out-of-service testing; and as a mux/demux tester.

The unit measures error count/ratio, level and frequency, delay, alarm monitoring/recording, etc., and performs error evaluation in accordance with CCITT Rec. G821 (histogram display presentation). The analyser has a large, easy to read LCD display of 128 x 128 points, a membrane-style key panel, inbuilt loudspeaker and microphone. It has an internal memory for the storage of up to 1000 test results (of periods up to 365 days) and nine individual test set- ups. The memory is non-volatile meaning that the previous setting is restored at power on. An AC line adaptor and rechargeable battery pack are provided with the analyser, as is a V24 interface for remote control or the connection of a suitable printer.

For further information circle 208 on the reader service coupon or contact Siemens, 885 Mountain Highway, Bayswater 3153; phone (03) 721 2338.

Microwave signal generator

Microwave signal generator SMP is the high frequency member of the new signal generator family from Rohde & Schwarz. The SMP is able to supply signals for any measurements on radar and communications receivers. A wide range of extensions ensures universal use in R&D, production, EMC measurements and material testing.

The basic model covers a frequency range from two to 20GHz. The lower frequency limit can be extended optionally to 10MHz. A modern frequency synthesis concept with direct digital synthesis provides stable output frequency with high frequency resolution and fast settling after a frequency change.

The SMP is available in two models, and in each the output level is controlled and frequency response compensated. The standard model SMP.02 has an ouput level greater than 10dB while the high power model SMP.22 has an output level of greater than 20dBm. The output levels specified for both models are valid over the entire frequency range of each instrument. High spectral purity is ensured by the use of advanced YIG oscillators without further frequency mulipying. AM and FM modulations meet the high standard usually found only in low frequency generators. The large variety of options includes a high speed pulse modulator with an on/off ratio of greater than 80dB.

The SMP has a large LCD display and menu guided operation with all menu levels being shown at a glance. Two menu memories are provided to speed up operation and help menus are available. The IEEE bus remote control commands correspond to the latest SCPI guidelines.

For further information circle 209 on the reader service coupon or contact Rohde & Schwarz, 63 Parramatta Road, Silverwater 2141; phone (02) 748 0155. ❖

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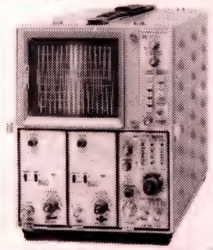

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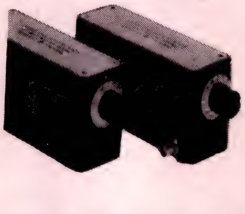

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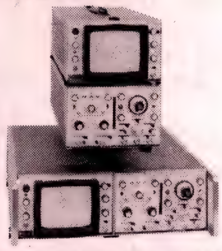

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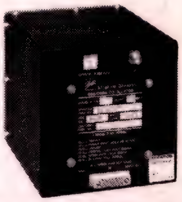

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DANA	7-1/2	DMM & Freq.	$175
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ELGENCO	603A	White Noise Gen 5MHz	$200
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FLUKE	102	VAW Cal Meter	$125
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GR	1191-B	Counter DC-35MHz	$150
GR	1608	LCR Meter	$1500
HP	211B	Square Wave Generator	$275
HP	302A	Audio Selective Level Meter	$145
HP	400L	True RMS Voltmeter	$170
HP	410B	Vacuum Tube Voltmeter	$130
HP	432A	Power Meter (c/w cable & sensor)	$875
HP	467A	Power Amp	$175
HP	536A	Frequency Meter	$150
HP	721A	30V 0.3A Power Supply	$60
HP	1610B	Logic Analyser	$350
HP	1980	100MHz Storage Oscilloscope	$1650
HP	3400A	True rms voltmeter	$425
HP	6226A	Power Supply 40V 1.5A	$200
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MARCONI	TF1020A	RF Power Meter 75Ω 100W	$75
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MARCONI	TF2303	AM/FM Mod Meter	$550
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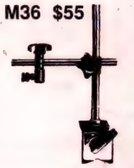

VCE-150	150mm/6" Electronic Digital Vernier in box	$120
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JUNE SUPER SPECIALS

TEKTRONIX 465M
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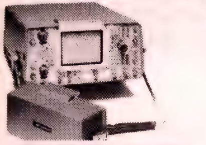

Bandwidth DC to 100MHz; Rise time <=3.5ns; Deflection factor 5mV/div to 5V/div in 10 steps; DC accuracy ±2%; 2-channel display mode; Horizontal deflection - main & delayed timebases; A - 0.5s/div to 0.05µs/div in 22 steps; B - 50ms/div to 0.05µs/div in 19 steps; Trigger - main/delay sweep; Coupling AC, DC, LF Rejection, HF Rejection

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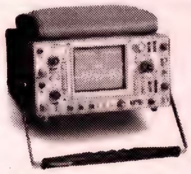
TEKTRONIX 475
200MHz Oscilloscope



Bandwidth DC to 200 MHz; Rise time <-1.8ns; Deflection factor 2mV/div to 5V/div; 2-channel display mode; Trigger view; Horizontal deflection - main & delayed timebases; A+B 0.01µs/div to 0.5s/div; x10 mag extends max sweep rate to 1ns/div

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READER INFO NO. 31

NEW PRODUCTS

Cassette on soldering

Royel International have released a cassette and a 20 page pamphlet describing soldering technology. The pamphlet complements the cassette and both give valuable information on current soldering techniques.

The pamphlet is illustrated and covers surface mount as well as conventional soldering and desoldering. The cassette is about 45 minutes long and includes an introduction by Alan Royston, the Managing Director of Royel.

Royel are also developing a video, which will be available for around $25 later in the year. The cassette and pamphlet cost $10, which includes postage to anywhere in Australia.

For further information, circle 248 on the reader service coupon, or contact Royel International, 27 Normandy Road, Notting Hill 3149; phone (02) 918 6769 or (03) 543 5122.

Ozone safe flux cleaner

Electrolube has released Fluxclene, a fast drying and specially formulated cleaning solvent to quickly and easily remove flux residues after hand and automated soldering. Fluxclene is non-ozone depleting and a superior replacement, both environmentally and operationally for CFC 113 and 1.1.1 trichloroethane.

ELECTROLUBE
E
FLUXCLENE
PCB Cleaning Solvent
Pulitore per Circuiti Stampati
Limpiador para Circuitos Impresos
Printplaten Reinigingsmiddel

The cleaner evaporates rapidly, swifly removing greases and oils, as well as flux residues from PCBs. As well as removing difficult, baked on flux after hand soldering, Fluxclene is ideal for removing excess solder paste from printing screens.

The chemical is harmless to most plastics, rubbers, elastomers and surface coatings and comes in bulk containers or 200 and 400ml aerosols, which can be used upside down.

For further information circle 243 on the reader service coupon or contact CLC Agencies, 51 Armitree Street, Kingsgrove 2208; phone (02) 750 4005.

Throw away electronic gas alarm

MSA has launched a maintenance free, disposable gas alarm that is little bigger than a matchbox and can clip onto a coat lapel, pocket or hardhat.

There are three Crickets in the range — one for oxygen (O_2) monitoring, another for carbon monoxide (CO) and the third for hydrogen sulphide (H_2S). The Cricket O_2 model sets off an alarm if the oxygen level falls below a preset level. The CO or H_2S models trigger an alarm if levels of these gases rise above preset levels.

Each alarm has two safety levels — warning and alarm. When the warning preset point is reached, an intermittent audible alarm and blinking LED are triggered. As tne concentration is increased the pulse rate or 'chirp' becomes more frequent.

The Cricket operates from a tiny 3V lithium battery and has a high performance sensor. Both last at least a year, after which the Cricket is discarded. A test button ont he front of the unit is used to check the alarm function and the battery

Photo-electric detectors

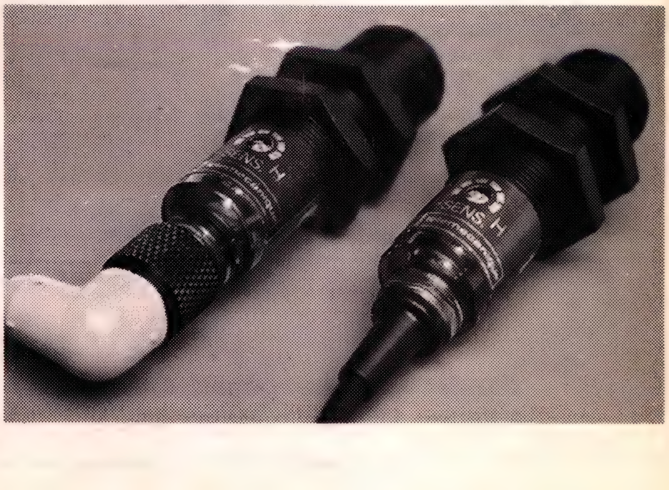
Schneider has announced a new range of short case photo-electric detectors from Telemecanique. The new XUB range is designed to be compatible with all industrial applications where photo-electric detectors are an important part of the control process.

The new range includes five models, in a cylindrical M18 x 1mm threaded case with detection ranges from 100mm to 10 metres. Through beam, reflex, polarised reflex and diffuse models are included in the range. All units have adjustable sensitivity and transparent, opaque or reflective objects can be detected with a switching frequency of up to 400Hz.

The XUB through-beam model emits a powerful infrared beam, and is suited to heavily polluted, misty or dusty air applications, providing a high margin of operational reliability under these conditions. A right angle mirror attachment accessory provides a sensing axis perpendicular to the sensor's axis and is indexed to prevent rotation on the cylindrical body.

In operation, the Telemecanique XUB range has a red alarm LED indicator to assist in setup, or communicate that a dirty lens or short-circuit has occurred. A yellow LED indicates the unit's output status. Voltage supply is 12 - 24V DC, and output current is 100mA.

For further information circle 241 on the reader service coupon or contact Schneider Australia,Unit 1, Block Q, Regents Park Estate, Princes Road East, Regents Park 2143; phone (02) 743 7700.



life at any time, so the user is always confident the monitor is operating.

For further information circle 244 on the reader service coupon or contact MSA Australia, 137 Gilba Road, Girraween 2145; phone (02) 688 0333.

Auctioneering diode assemblies

Amalgen Control Systems has released a range of auctioneering diode assemblies for use with their DC power supplies. These assemblies are used when supplying a critical DC load. Usually they are connected on the output side of two DC power supplies and the load is connected to the output of the diode assembly.

Providing the output voltage from each DC power supply is identical, they will share the load. However, if one of the DC power supplies, or the output voltage varies between the two, the auctioneering diode assembly will transfer the load to the DC power supply with the higher output voltage.

Because of this load transfer feature, the assembly should be selected so it's rated at the full load current. The assemblies are available in 10A, 30A, 63A and 100A ratings, at 0 - 100V DC.

For further information circle 242 on the reader service coupon or contact Amalgen Control Systems, 43 Anderson Road, Mortdale 2223; phone (02) 570 2855.

Phone and data sockets from HPM

HPM's new range of RJ series data and telephone outlets are designed to minimise wiring time for the installer. Their compact size allows multiple sockets on each plate, designed to snap into standard 770 series and XL770 series switch plates. They are ideal for quick connection and are provided with an insulated moulded cap which covers the insulation displacement terminals. The RJ6 is rated category four and the RJ8A5 is rated a high category five, making it ideal for all types of computer installation.

For further information circle 243 on the reader service coupon or contact HPM Industries, 4 Hill Street, Darlinghurst 2010; phone (02) 361 9999.

Environmental test kit

ITT-Metrix has introduced a new modular test kit for checking environmental and electrical parameters during the professional installation and servicing of heating, ventilating and air conditioning systems in commercial, industrial and other climatically controlled environments.

The new CX51 system will measure temperature, humidity, air speed and light level as well as standard electricl measurements. The test kit is based on the company's MX51 handheld digital multimeter and also contains a measuring sensor interface, four interchangeable sensors, two electrical test probes and a telescopic handle to assist measurement in difficult locations.

The CX51 uses a PT100 platinum resistance sensor to measure temperature from -40°C to +80°C with a resolution of 0.1°C and an accuracy of +/-0.5°C. Humidity measurement range using a capacitive sensor is from 10% to 98% RH, with a resolution of 0.1% RH and an accuracy of +/-3% RH.

Air speed is measured using a hot wire anemometer, and covers the range 0 - 10m/s, with a resolution of 0.1m/s and an accuracy of +/-2%. For light level measurements, a silicon cell with a built in correction filter is used to give a range from 0 to 100,000 lux, with a resolution of one lux and an accuracy of +/-5%.

The MX51 multimeter has all the standard DC and AC voltage, current and resistance ranges, plus continuity and diode test facilities and an adaptor input for the measuring sensor interface. It also features a bargraph display in addition to the normal digital readout, plus a number of memory modes including Live Trend display, hold facility, Min Max survey, relative and peak hold.

For further information circle 245 on the reader service coupon or contact Nilsen Instruments, 150 Oxford Street, Collingwood 3066; phone (03) 419 9999.

Low volt cutout protects motors

The HPM power monitor is a single powerpoint which comes in 10A and 15A models. It is designed to protect appliances such as air conditioners, fridges and freezers, and is particularly suitable for country areas where the power voltage often drops below 200 volts. When this occurs, the appliance motor can burn out. However, when the voltage drops, the power monitor cuts power to these appliances before harm can be done.

It then monitors the supply voltage over a period of five minutes. If it remains stable at normal voltage, the power monitor will again supply power to the appliances. The power monitor has a neon light to show when power is being supplied to the appliances.

For further information circle 246 on the reader service coupon or contact HPM Industries, 4 Hill Street, Darlinghurst 2010; phone (02) 361 9999. ❖

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READER INFO NO. 32

Silicon Valley NEWSLETTER

Envoy debut at mobile conference

Personal Communicators will become a big market. But at the annual Mobile '94 conference and trade show in San Jose, it was clear no one in the infant industry yet knows when that will happen, or what consumers really want to do with this new generation of pocket devices.

Even Motorola president Chris Galvin said in his keynote address that broad market acceptance for personal communicators and PDAs is likely to take a decade, just as it took televisions, car radios and many other consumer electronics products about that long before becoming an item most consumers could no longer do without.

Motorola used the Mobile '94 show to debut its 'Envoy' personal communicator. At an introductory price of US$1500, the device is hardly in the price range of many consumers, but the company is confident that the machine will evolve into a major player in the future market.

According to Hewlett-Packard and Novell officials, prices of basic personal communicators will fall to less than US$300 by the end of 1995. The prediction was made as the two firms announced they had jointly invested undisclosed amounts in Geoworks, a small company whose 'GEOS' operating system is used in Tandy's Zoomer personal digital assistant.

H-P said it will work with Novell to develop a new line of personal communicators that will integrate with Novell's networking technology and H-P's expertise in making small pocket and handheld devices such as the Omnibook and 95LX.

H-P said it hopes the resulting product will cost less than US$500 and perhaps less than $300 for a base model. The device would use infrared signals to send and receive data wirelessly.

What the H-P device will lack is true two way wireless communications, a major feature of Motorola's Envoy, which was launched at an elaborate reception with the motto 'No Wires, No Limits'. The Envoy which will not be available in stores for another six months, is also the first system on the market using General Magic's 'Telescript' communications language and the 'Magic Cap' operating system and user interface.

Built around the Motorola 68349 'Dragon' chip set, the Envoy allows users to instantly access and send data to and from anywhere. Users enter data by electronic stylus or even using their fingertips to push icons or an on-screen keyboard. They can also send hand written messages by fax.

The Envoy's communications capabilities are generated by the wireless packet data modem from Motorola, built as standard into every Envoy. Users can also hook the device up to regular phone lines, or exchange data with other Envoys in the same room by infrared signal. Envoy users are offered two wireless communications services, PersonaLink from AT&T and RadioMail from the eponymous company. They are offered via the Ardis wireless data network, which is active in 400 metropolitan areas in the United States.

Motorola's new 'Envoy' Personal Communicator, which uses MagicCap.

Washington forms alliance with chip industry

President Clinton has unveiled a broad new four point partnership program for unprecedented cooperation between Washington and the US semiconductor industry. Meeting at the White House with top executives from 50 of the most prominent US chip makers, Clinton and Vice President Gore said the administration is determined to ensure the US semiconductor industry will be able to maintain its new worldwide leadership position.

A key feature of the program calls for the establishment of a new US$100 million semiconductor research centre to be built at the Los Alamos National Laboratory. Clinton also announced agreement on a broad partnership between the federal government, the semiconductor industry and major US universities for cooperation on a number of chip related development projects.

Vice President Al Gore, meanwhile, told the executives that the latest figures on semiconductor trade gathered by the US Commerce Department confirmed that the US industry had recaptured worldwide marketshare leadership from Japan in 1993. After trailing Japan by 13% as recently as 1988, the industry captured 43% of the world chip market last year ahead of Japan's 42%.

Calling the electronics industry the 'engine' that is pulling the US economy Gore told the 50 industry executives during the White House ceremony that "This administration is committed to maintaining that lead."

Highlights of the new partnership include:

- The Los Alamos facility will use the engineering skills of its top-notch engineering talent to develop highly advanced software to model, test, and simulate new computer chip designs. The cost of building and operating the research facility will be split evenly between Washington and the members of the Semiconductor Industry Association.
- The second part of the partnership involves plans for a US$25 million Metrology project, which will be aimed at developing the extremely precise measuring instruments which will be needed by the semiconductor industry to build ICs that will contain up to a billion — or more — transistors.
- Also present at the ceremony was

incoming Deputy Secretary of Defense John Deutsch, who said the third respect of the program involves the Pentagon, which has pledged to continue to invest hundreds of millions of dollars on semiconductor related research projects despite cutbacks in defense expenditures. "We have had a long history of cooperation with the semiconductory industry. We helped lay the technological and scientific base for this industry. We shall continue."

Sematech will continue to play a key role in the new partnership between the industry and Washington, Deutsch assured. Under President Bush, there had been several high level efforts to scale back support for Sematech, which receives US$100 million a year in federal subsidies.

- Finally, the National Science Foundation will support a newly established National Nanofabrication Network, a group of five universities which will seek to develop prototype components with features that are many times smaller than today's state of the art chips built with 0.3 micron lithography.

Said Gore: "The technological challenges are enormous. We need to measure particles as small as three nanometres (0.003 micron)."

Intel executive vice president Greg Barrett said the miniaturisation to be made possible with the new programs will enable companies like Intel to build PC chips with processing speeds up to one billion instructions per second by the year 2000, compared with current 50 million IPS.

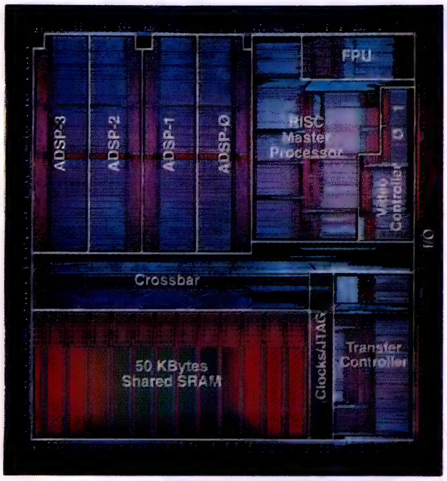
'Revolutionary' Super DSP chip

At a recent press conference in San Francisco, Texas Instruments launched what may well become one of the most revolutionary chips since Intel's 8086 microprocessor. The next generation digital signal processor will enable computer and other electronic industries to revolutionise the way audio, video, text and other data can be used.

The so-called 'Multimedia Video Processor' (MVP) chip, contains four million transistors on its 3/4 square inch surface (0.5 micron, 3.3V CMOS process) and processes digital signals at the rate of two billion operations per second (2BOPS), 10 times faster than any other DSP chip on the market today and 50 times faster than a Pentium processor from Intel.

With the fully programmable MVP (officially known as the TM8320C80), companies will be able to build advanced, low cost multimedia systems for such applications as video teleconferencing, image and document processing, as well as many applications related to the data superhighway — such as video-on-demand set-top boxes.

Priced at US$400, the MVP chip will allow makers to vastly reduce the size and increase performance of current products. One company, Printrak, showed how the MVP chip had enabled the company to reduce its system design from 28 circuit boards to just one board, a 98% system size improvement.



TI's new 'multimedia video processor' (MVP) chip, which includes four DSPs.

Samples of the MVP chip have already been shipped to customers worldwide. Pre-production quantities will be increasingly available throughout 1994, with full production beginning in the first quarter of 1995.

The MVP chip's architecture features a 32-bit RISC based master processor with a 100MFLOP floating point unit built-in, as well as a transfer controller with a 400MB/sec off-chip transfer rate. The chip also has a video controller and 50KB of SRAM.

The key feature of the MVP architecture, however, is the integration of four advanced DSP processors, operating independently or in parallel under an on-chip operating system.

"The MVP is 50 times faster than the Pentium. It will open the door for new applications that only exist in our imagination today. The MVP achieves levels of semiconductor integration and performance never seen before," said Rich Templeton, TI's worldwide manager for ASIC products.

The MVP and DSP chips in general, he said, will have the same impact on the electronics industries of the 1990's that microprocessors had on the computer industries of the 1980's. The MVP represents the launch of an 'enabling technology', which will spark the development of a vast array of new products and applications, perhaps entire new industry sectors.

According to Sony senior vice president Tei Iki, his company is keen on coupling the MVP with the company's digital chassis and integrated peripherals to produce new appliances for the information superhighway. Iki said Sony will also be using the chip to produce superior new Trinitron-based computer display terminals.

Other companies announcing products or support for the MVP included SuperMac, Spectrum Microsystems, Longborough and Northwest Digital Systems, which is implementing the MVP chip into its X Window System-based X terminal servers to provide X Window System users unprecedented multimedia applications.

Two large defence contractors merge

Two of America's major defence industry contractors have agreed to merge. Martin Marietta said it will pay US$1.9 billion for Grumman, a New York based aircraft builder which has been struggling in the aftermath of the Cold War.

The combined company will have annual revenues of more than US$13 billion, making it among the biggest defence firms with sales rivalling those of Lockheed and McDonnell Douglas.

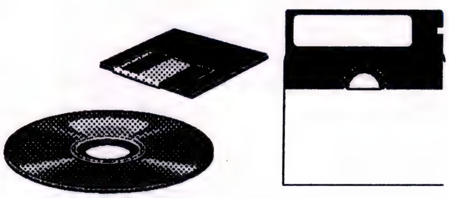
The merger is the latest in a trend towards consolidation in the defence industry, which started about three years ago with the first rounds of defence budget cuts.

Martin Marietta has been particularly aggressive in buying up struggling defence operations. In the past two years the company has acquired the defence unit of General Electric, General Dynamics' space booster rocket group as well as several smaller companies.

Most industry analysts agree that the trend will continue for some time, until a small core of huge defence firms will be left to dominate the world's arms market. While there will remain some room for start-ups, particularly in high tech areas of defence technology, most of these firms are likely to be swallowed up by the larger firms or be so dependent on one or more of them they will have little control over their own destiny.

The consolidation will also continue to put more people out on the street. The Marietta-Grumman merger is expected to cost some 10,000 to 15,000 people their jobs. ◆

SPOTLIGHT ON
SOFTWARE



Picture Publisher 4.0

Micrografx's very popular Windows-based image editing package *Picture Publisher* has recently had a major upgrade. Along with a lot of enhancements to its user interface, the new version 4.0 has many new features — including some of special interest to anyone who needs to manipulate image files for subsequent printing.

by JIM ROWE

When the opportunity came along to review the new version 4.0 of *Picture Publisher*, I must confess I jumped at the chance. I've been using the previous version for nearly two years (it came bundled with my AVR scanner), and although becoming familiar with it took quite a while (it's a very powerful package), it soon became my favourite. I'd heard that the new version 4.0 was even better, and this has certainly turned out to be the case.

In fact I gather that *PP4* really is a major upgrade of the product, which was produced by Micrografx following a big survey of registered *Picture Publisher* users in the USA. Everyone was asked for their suggestions on improving the package, and wherever possible these were used in developing the new version.

As you'd expect, the new version offers all of the basic image management and manipulation functions of its predecessor. This includes a standard Twain interface for scanners, so as before you can easily pull in an image directly from your scanner. And of course you have all of those powerful image masking functions which made *PP3* so popular — plus some more again. You also have the 'ImageBrowser' function, with its handy 'thumbnail' images for quickly finding a saved image file on various directories and/or disks (except that this is now enhanced, too). And of course there's still the ability to perform closed-loop calibration of your scanner and printer, and visual calibration of your monitor.

It's hard to know where to start, when it comes to describing the extra features and facilities that *PP4* provides. One of the main extras is Object Layers, which brings to image editing the same order of control flexibility that we've all become used to in drawing programs like *Corel Draw*. Now when you add text to an image, or paste other image elements into it, or use a mask to define a section of the image so you can duplicate or copy it, these changes don't graft immediately into the main bitmap image, but become distinct *objects* which effectively reside on different layers — so you can select them, move them, change their size, rotate them, skew them, and otherwise manipulate everything until you're happy. No more having to 'undo and try again'!

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PICTURE
PUBLISHER

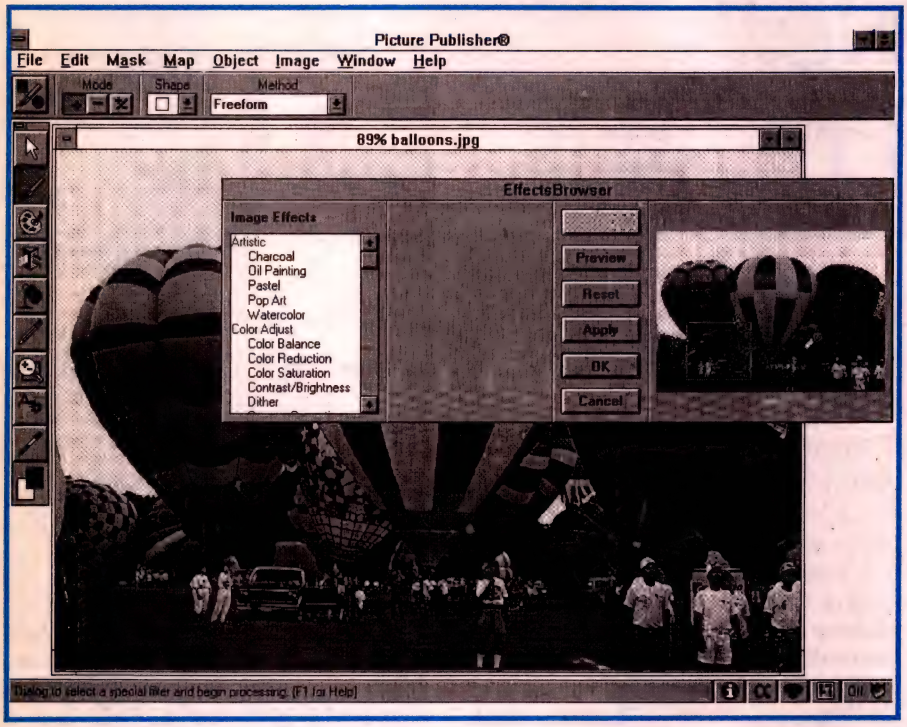
You can select single objects, apply special effects to them, group them for common treatment and then ungroup them again, and so on. This is a major improvement in user convenience, compared with both *PP3* and other image editors, and once you've tried this facility you'll never want to go back.

Another couple of important new features are specifically designed to help users working with very large image files — like those in high quality print publishing. Called FastBits and Low Res Image Open, they're both designed to speed up work on large images. Low Res Image Open allows you to open a low resolution version of a large image file, to try out global changes such as colour corrections or unsharp masking; then when you get the overall result you want, it can be applied to the full image file. FastBits on the other hand allows you to pull up a low-res preview of the main image, divide it into 'bits' with a grid, and then just open one or more specific chunks of the image (at full resolution) for editing. This is just the shot if you really only want to retouch one or two small areas.

Both Low Res Image Open and FastBits are very nice features, allowing you to speed up what would otherwise be relatively slow and tedious operations.

While these are what you'd call the 'big' additions to *Picture Publisher*, there are a large number of additions and enhancements which are smaller in themselves, but are collectively very impressive. These include:

- Zooming in to examine small areas of an image is now a lot easier and faster, thanks to a new QuickZoom facility with its own separate linked 'preview window'. Pull a bounding box on this preview image, and this part of the main image is blown up to fill the main window. Click on a different part of the preview screen, and the bounding box moves there — with the main screen changing to a closeup of that section.
- The ImageBrowser facility of *PP3*, with its 'thumbnail' images to let you



Dialog to select a special filter and begin processing. (F1 for Help)

PP4's special editing effects are accessed via the 'EffectsBrowser' dialog box.

find images on a disk or CR-ROM, is now even better. The thumbnails are now displayed faster, and there's better facilities to manage them.

- In addition to all of the file formats supported previously, it now supports CMYK TIFF, JPEG and AVI (audio-visual interleave) files, as used in multimedia applications.
- As well as the AutoMask (tracing), SmartMask ('Magic Wand'), Colour Shield and other fancy masking facilities of *PP3*, the new version also allows eight-bit masking and supports 'plug-ins' for Gallery Effects and Adobe Photoshop. Masking is now also rather more friendly and intuitive, and there's a 'rubylith' facility, to let you directly edit the mask and be sure of which way around it's going to work (this was a bit tricky, with *PP3*!).
- Many of the 'global' image editing functions are now accessed more easily via an EffectsBrowser, which lets you preview their effect before you apply them to the main image.
- As well as having the 'joystick' method of adjusting image brightness and contrast, there's now an alternative visual mode where you see a 2D array of 'thumbnail' versions of your main image, with previews of different combinations of incremental changes in the two parameters; you can just click on the one you want.
- Similarly, there's now the same choice of 'joystick or visual' methods for changing colour balance. Very nice!
- A new Macro facility lets you 'record' sequences of operations you perform frequently, or easily duplicate on the full file what you've tried out using the Open Low Res Image function.
- An 'Album' facility lets you save and retrieve images in groups or albums, for greater convenience.

An 'Information' button in the ImageBrowser gives you a rundown on all of the main parameters of an image file, before you open it. Then when you *have* opened it, you can open an Image Size dialog box, to manipulate many of these parameters as desired...

These are just a few of the many new facilities in version 4.0. The more you use it, the more you find — it's an incredibly powerful package. There's just about everything for the professional, but at the same time a lot of the horsepower is 'hidden under the bonnet', so beginners wouldn't find it too daunting.

If you're after a really good Windows-based image editing package, this one will certainly take a lot of beating.

The RRP for *Picture Publisher 4.00* is quoted as $795, with *PP3* users able to upgrade for $245. Further information is available from Micrografx Australia, of Level 5, 10 Help Street, Chatswood 2067; phone (02) 415 2642. The package itself is available from Sourceware, Software Suppliers, Merisel and Proscan. ❖

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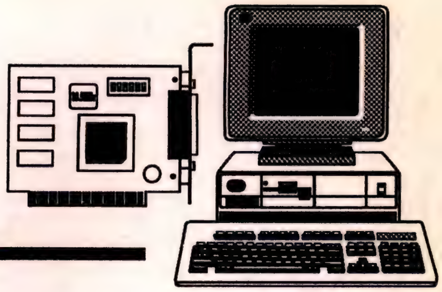
Computer News and New Products



Ethernet adaptor for portables

INC Manufacturing has released its LT-2 Ethernet Adaptor for portable computers. The pocket sized adaptor is lightweight and comes with a self-powering cable that takes its power from the portable PC. It connects to the computer's printer port and uses printer port signals for network communication.

The adaptor incorporates dual interfaces for 10BaseT (RJ45) and 10Base2 (BNC) Ethernet LANs. Four LED status indicators monitor power, transmit/receive signals, UTP link and media type. The INC LT-2 adapter is priced at $315, excluding tax.

For further information circle 162 on the reader service coupon or contact INC Manufacturing, Unit 2, Block R, 391 Park Road, Regents Park 2143; phone (02) 645 2200, free call 008 807 982.

Portable fax/modem from Banksia

Banksia Technology has launched its Windows compatible fax/modem, called the Joey. Described as a high quality pocket modem which is equally suited to desktop use, the Joey is priced at $299. It transmits faxes at 9600pbs and offers two-speed data transmission at up to 2400bps. It features V.42 error control and V.42bis data compression, both via QuickLink II software.

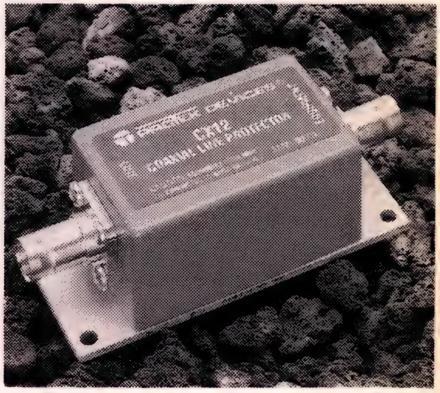
Although there are no LED indicators on the Joey, the software shows an on-screen indicator panel which simulates those on a modem. The modem is a fully featured asynchronous, full duplex device that supports the AT command set, and includes auto-dial, auto-answer, auto-ranging and auto-disconnect.

Other features include call progress monitoring and analog and digital loop-back diagnostics. The volume of an internal speaker is adjusted by the AT command set. The Joey complies with the V.22 (A)(i), V.22bis and Bell 103 212A standards. It also complies with TR29.II Class 1 standard for Group III fax transmission.

The Joey comes with QuickLink II communications software for Windows (DOS and Apple also available), serial cable, power adaptor, battery and a two-year warranty.

For further information circle 161 on the reader service coupon or contact Banksia Technology, 83 Longueville Road, Lane Cove 2066; phone (02) 418 6033.

Data line transient protector



ProTek Devices' new CX12 Coaxial Line Protector series is specifically designed to protect interfacing equipment from transients caused by lightning, inductive switching and electrostatic discharge. The devices are suited for the protection of audio visual, video, Ethernet, Token Ring and other LAN interface systems requiring coaxial cables.

The CX12 models are two stage hybrid devices and provide primary and secondary levels of protection.

Two models are available. The standard CX12 is designed for speeds of less than 10MHz and has an operating data rate range up to 10MB. The CX12LC is for speeds above 10MHz and has an operating data rate range up to 100MB. Maximum operating line voltage for both is +/-12Vpk while maximum operating line current is 200mA. Both have a response time of less than 10ns, a maximum clamping voltage (8/20us) of +/-20Vpk at 500A and +/-28Vpk at 2000A, and maximum voltage and current transient ratings of 20kV and 3000A (8/20us), respectively. Reset is automatic so that service will not be interrupted.

READER INFO NO. 36

V32bis

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The CX12 features a maximum capacitance (0V, 1MHz) of 200pF, throughput resistance of three ohms, and a maximum insertion loss at 10MHz of 0.5dB. The CX12LC ratings at 25pF, 10 ohms and 0.1dB, respectively. Both are completely enclosed in a rugged aluminium housing which provides shielding to meet industry standards. Standard BNC-type connectors allow easy in-line installation. Other connector types are available.

For further information contact ProTek Devices, PO Box 3129, Tempe, Arizona 85280; phone (602) 968 6060.

Colour laser rental

Tech Rentals now has the QMS ColorScript Laser 1000 printer available for short term hire. This is the first desktop laser printer that produces both high quality colour as well as high quality black printing in a single device. The colour monochrome laser technology produces a spectrum of colours for business printing, using combinations of cyan, magenta, yellow and black laser toner.

The QMS ColorScript Laser 1000 printer has dual paper trays (250 sheets of paper or 75 transparencies), supporting a wide variety of media including plain paper, standard transparency film and laser quality labels. The printer comes standard with 12MB RAM expandable to 32MB RAM, and a 60MB internal drive. Languages include PostScript levels 1 and 2, (65 resident typefaces), HP PCL 5 and HP-GL. Interfaces include LocalTalk, RS-232C serial, Centronics and Ethernet.

For further information circle 166 on he reader service coupon or contact Tech-Rentals, PO Box 621, Ringswood 3134; phone (03) 879 2266.

ligh speed oscilloscope card

Gage Applied Sciences has released a 100 megasample/second (100MS/s) digital storage oscilloscope card for PCs, claimed as the highest speed PC-based lata acquisition card in the world. Called he Compuscope 250, the card runs at 00MS/s on channel A or at 50MS/s on channels A and B simultaneously ampled. The card has AC or DC coupling, and can drive slave units to provide up to eight channels at 100MS/s or 6 channels at 50MS/s.

The card can trigger from channel A, hannel B, externally or from the keyboard, and with its on-board memory, vill allow mid, post or pre-triggering o capture relevant information even t full sample speed. The timebase is ndependent on all channels, and can sample from 1Hz to 100MHz in a 1-2-5 sequence.

Oscilloscope software is provided with the card which supports independent scrolling of all channels, horizontal zoom and zero reference adjustment. Printer output is supported as well as ASCII, Asyst, DADisP, Lotus 1-2-3 file formats. Software modules are available to run with the oscilloscope software which allow processing of the acquired data, including such functions as FFT, differentiation, arithmetic etc.

The card fits any PC-XT/AT/386 and has driver software for incorporating it into the user's own software.

For further information circle 163 on the reader service coupon or contact Boston Technology, PO Box 1750, North Sydney 2059; phone (02) 955 4765.

Fast 8M bit E(E)PROM programmer

Boston Technology has announced the Australian release of its HEP-80X series of new-generation high speed, high capacity PC-based E(E)PROM programmers. Devices supported include bytewide EPROM/CMOS EPROM from 2716 to 8M bits, page mode EPROM from 27513, 27011 to 8M bits, EEPROM such as 2816, 2864A and 28256A.

The programmer has independent control keys and a separate master socket. These features suit volume production, and the response is displayed with LEDs. User friendly menu driven software is supplied with the programmer, and functions include blank check, read verify, program, file load and save, screen edit of binary and ASCII data. Hex to binary conversion, and 2/4 way binary file splitting and shuffling are also supported.

For further information circle 164 on the reader service coupon or contact Boston Technology, PO

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PCMCIA serial and parallel cards

Interworld Electronics has announced the release of PCMCIA serial and parallel port cards from Quatech. Four cards are available: SPP-100 parallel port, SSP-100 RS-232 serial port, the SSP-200 RS-422 serial and SSP-300 RS-485 serial port card. The parallel port card provides a single channel bi-directional enhanced parallel port interface. It has software configurable base address and interrupt selection (supports IRQ 3-7, 9-12, 14-15). The serial cards all use the high speed 16550 UART and have software configurable addressing and interrupt selection. The cards can be 'hot-swapped', which means they can be removed or inserted while the computer is powered up.

For more information circle 165 on the reader service coupon or contact Interworld Electronics and Computer Industries, 1000 Glenhuntly Road, Caulfield South 3162; phone (03) 563 5011.

PCMCIA-compatible Flash cards

Maxtor Australia has announced a new line of PCMCIA-compatible Flash memory cards which offer access time three times faster than SRAM memory cards, as well as a significant cost advantage. Developed for the mobile office, MobileMax Flash memory cards will enhance data storage of handheld computers and personal digital assistants which run applications with storage requirements of between 2MB and 20MB, and also demand a long battery life.

MobileMax Flash Cards feature an innovative power management design that, when compared with other Flash offerings, provides users with extended system battery life.

They also have an added advantage over SRAM in not requiring a battery for data retention — eliminating the risk of losing data while changing card batteries or during battery failure. The MobileMax product line consists of a series of Flash memory based PCMCIA type I cards with capacities of two, four, eight, 12, 16 and 20MB and are the first of a series of products resulting from Maxtor's alliance with M-Systems, Tel Aviv, for the development of Flash memory based PCMCIA products.

Colour scanner

Genius Australia has released a high quality colour scanner which provides true 24-bit colour images to Windows based desktop publishing and presentation packages. The Genius ColourPage-1 is an A4 sized flatbed scanner that delivers up to 16.7 million different shades of colour using sophisticated CCD sensors. It can also scan in true grey scale or black and white modes.

The scanner can handle images as large as 216mm x 343mm (8.5" x 13.5" - legal size) with a maximum resolution of 1200 dots per inch. The scanning speed is 70 seconds to scan an A4 page in colour mode and 14.4 seconds in greyscale or black and white mode.

The ColourPage-1 flatbed scanner retails for $2349, but is being introduced to the Australian marketplace at $2100 for a short period. The package comes with iPhoto Deluxe image processing software and interface card. Purchasers can also buy Recognita OCR software for $150 extra and the ADF-1 document feeder for an extra $900. Minimum recommended requirements are IBM 386 system with at least 4MB or RAM.

For further information circle 167 on the reader service coupon or contact Genius Australia, 4 Briar Street, Fulham Gardens 5024; phone (08) 235 2388.

12-bit 1MHz A/D board

The WIN-30D is an ultra high performance multifunction analog (with DSP and digital I/O board for PC-AT compatible computers.

It offers full 1MHz throughput, dat packing, and a choice of bursting DMA, 16-bit rep string operations, or for the ultimate in efficiency, 32-bit rep string operations.

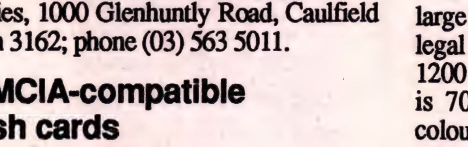
The board has 16 single-ended inpu channels, with switch selectable ranges and high impedance inputs. Input voltage range is selectable to either 0 to 5V or +5V to -5V. All configuration is performed through software, including DMA and interrupt levels.

The WIN-30D also features channe listing, which specifies the sequence in which input channels should be scanned This allows complete flexibility in sampling, as channels can be samples in any sequence, and allows the WIN-30D to maintain its full 1MHz throughput regarding of the number of channels selected. The user also has the option o data packing. This packs four 12-bit data samples into three 16-bit words, meaning that for each four 12-bit samples, the host PC has only to perform three 16-bi AT-bus transfers. This feature reduces the WIN-30D's maximum data rate from 1mHz to 750kHz.

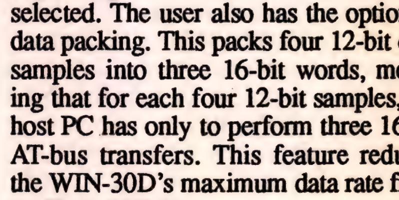
Software supplied with the card includes: UEIDAQ drivers (including source) for programmers for DOS, Windows 3.1 and Windows NT, driver fo Labtech Notebook and LabView, Status-30 for DOS, and Status for Windows.

For further information circle 169 on the reader service coupon or contac Boston Technology, PO Box 1750, North Sydney 2059; phone (02) 955 4765, fax (02) 955 4468. ◆

Australian Computers & Peripherals from JED... Call for data sheets.



$125 PROM Eraser,complete with timer



The JED 386SX embeddable single board computer can run with IDE and floppy disks, or from on-board RAM and PROM disk. It has over 80 I/O lines for control tasks as well as standard PC I/O. Drawing only 4 watts, it runs off batteries and hides in sealed boxes in dusty or hot sites.
It is priced at $999 (25 off) which includes 2 Mbytes of RAM.

$300 PC PROM Programmer.

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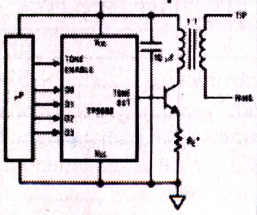

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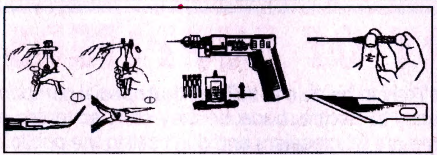

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A Kits and modules
B Tools
C PC boards and supplies
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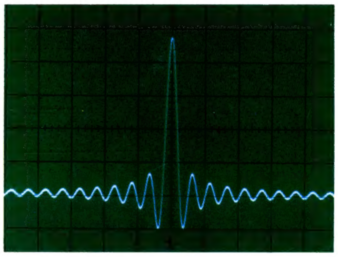

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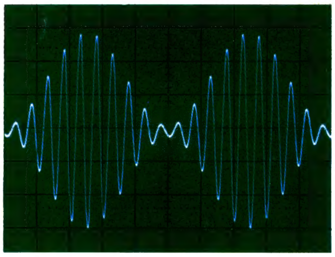

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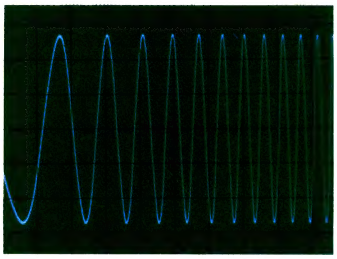

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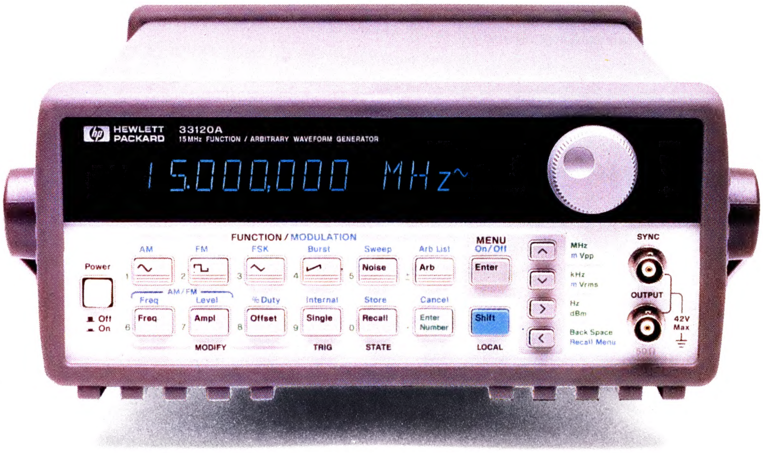

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